TREESHREWS: AN ACCOUNT OF THE MAMMALIAN FAMILY TUPAIIDÆ.

By Marcus Ward Lyon, Jr.,
Formerly of the Division of Mammals, United States National Museum.

INTRODUCTION.

This review of the treeshrews, constituting the mammalian family Tupaiidæ, was originally contemplated in 1904 by Mr. Gerrit S. Miller, jr., curator of mammals, United States National Museum, but owing to pressure of other work he was unable to carry it out. In 1910, shortly after I severed my active connections with the Division of Mammals, United States National Museum, Mr. Miller suggested to me the desirability of making a study of the treeshrews. I took up his suggestion and the present paper is the result. At that time he turned over to me some preliminary notes on the group he had made during a visit to European museums when he was primarily engaged in other lines of research. The increase of new material, both in the United States National Museum and in other museums, made it imperative that the entire field be gone over again. The collections in Washington were first studied, and during the summer of 1911 I visited most of the museums which Mr. Miller's previous work showed contained material valuable for this revision.

Specifically, the material examined consists of about 800 specimens, all of which are listed in the tables of measurements and distributed as follows:

British Museum, 355 specimens, 27 types.

United States National Museum, 324 specimens, 29 types.

Civic Museum of Natural History, Genoa, 37 specimens, no types.

Royal Zoological Museum, Berlin, 29 specimens, 1 type.

Museum of Natural History, Paris, 20 specimens, 1 type.

American Museum of Natural History, New York, 14 specimens, 1 type.

Natural History Museum of Geneva, 3 specimens, no types.

Natural History Museum of Turin, 1 specimen, no types.

In addition to the specimens mentioned above, in most museums, particularly the older ones, there are a number of specimens of very uncertain or generalized localities, which are unsuitable for systematic work, and they are not included in the above figures.

Proceedings U. S. National Museum, Vol. 45—No. 1976.
80459°—Proc.N.M.vol.45—13——1

In addition to examining specimens in these museums, I have also had for study specimens sent to Washington from the following institutions:

Museum, Philippine Bureau of Science, 12 specimens, 1 type.

Selangor Museum, Selangor, Straits Settlements, 8 specimens, no types.[1]

Academy of Natural Sciences, Philadelphia, 6 specimens, no types.

I was unfortunate in my time of visiting the Natural History Museum in Leyden. The director, Dr. F. A. Jentink, who has direct charge of the mammals, was on his vacation and I was unable to examine the specimens of Tupaiidæ in that museum. The material contained there as listed by Jentink[2] does not appear vitally important for a systematic review of the group, yet it contains some very interesting and historical specimens, which I regret not having seen. Among them are the unique type of *Dendrogale murina* and the only skeleton of the genus *Ptilocercus* that I know of existing in museums and the cotypes of *Tana dorsalis*. *Dendrogale murina* is the only species of treeshrew of which I have not seen examples.

I take pleasure in here expressing my thanks to the directors of the museums which I personally visited for giving me the privilege of studying the available material in their institutions, or from which material was borrowed.

The importance of the explorations of Dr. W. L. Abbott in our knowledge of the treeshrews can not be lost sight of. With the exception of less than a dozen specimens in the United States National Museum the entire series of treeshrews there was collected through his untiring efforts. This means that more than a third of the specimens of treeshrews in all the museums of America and Europe have been personally collected by Doctor Abbott. Among them are 29 types. Indirectly he is also responsible for the treeshrews collected by Messrs. Kloss and Robinson on the Malay Peninsula, or adjacent islands.

The text figures of the skulls and teeth of the various genera were made by Mr. A. J. Engel Terzi.

Measurements.—All the measurements are in millimeters. With the exception of those of the head and body and of tail of skins, they have all been made by the writer, including those of the hind foot, which includes the claws. In most cases the measurements of the head and body and tail were made by the collector in the flesh. In the tables of measurements where the head and body and tail measurements are followed by ±, those measurements were made by the writer from the dried skin or mounted specimen. Head and body and tail measurements of specimens preserved in alcohol were also

[1] There are, however, in the Selangor Museum, 4 types, none of which I have seen.

[2] Cat. Ostéol. Mamm. Mus. Hist. Nat. Pays-Bas., vol. 9, 1887, and Cat. Syst. Mamm. Mus. Hist. Nat. Pays-Bas, vol. 12, 1888.

made by the writer. Measurements of the skull followed by ± indicate that the measurement is only approximate owing to damage to the skull. Hindfoot measurements followed by ± are also only approximate. In the tables of measurements the specimens in the United States National Museum will be recognized by simple catalogue numbers, as 104362, without qualifying initials or footnotes; those in the British Museum by the well-known separation of these numbers into sections by means of periods, as 99. 6. 12.3; specimens in other museums will be found designated by appropriate and self-explanatory initial letters or by footnotes.

HISTORICAL ACCOUNT.

The earliest published account of treeshrews is that of Ellis,[1] one of the surgeons of Captain Cook's expedition. On Tuesday or Wednesday, 25th or 26th of January, 1780, Ellis remarks: "Our sportsmen * * * having seen only a few monkies, squirrels, and a cock and hen, the latter of which they shot. According to Linnæus this island is their native place." The island referred to is Pulo Condore, off the coast of Cochin China. The squirrels mentioned in the account are not squirrels, but Tupaias. One of them was evidently shot. A rough but very accurate sketch of the animal was made by Ellis and a Latin diagnosis of it written in his journal. This description of the animal was published by Gray in 1860.[2] Through the courtesy of the officials of the British Museum a reproduction of a photograph of Ellis's drawing is here printed. There can be no doubt from Ellis's picture or description that his squirrels were Tupaias (pl. 1).

Tupaias as such were first brought to the attention of the world by M. Diard, a French naturalist, at one time an assistant of Sir Thomas Stamford Raffles, in November, 1820, under the designation of *Sorex glis*.[3]

Six months later, May, 1821, the genus *Tupaia* was first proposed by Sir Thomas Stamford Raffles,[4] and the species *ferruginea* and *tana* described, the latter in the present paper being made the type of a new genus.

Specimens of Tupaias had been seen by Europeans several years earlier, and one even sent to Europe. Geoffroy [5] remarks:

> The discovery of this remarkable group of Insectivores has been attributed to both M. Diard and Sir Raffles. The fact is that it belongs to neither of these celebrated travelers, but to Leschenault de la Tour, who had sent in 1807 to the Museum of Paris an individual of the species which has since been called *Tupaia javanica*. Nevertheless it is only since 1820 that the attention of naturalists has been called to Tupaias, and that these animals have really entered the domain of science.

[1] Voyage by Capt. Cook and Capt. Clerke in ships *Resolution* and *Discovery*, 1776, 1777, 1778, 1779, and 1780, vol. 2, 1782, p. 340.

[2] Ann. Mag. Nat. Hist., ser. 3, vol. 5, 1860, p. 71.

[3] Asiatic Journ. Month. Reg., vol. 10, p. 478, November, 1820.

[4] Trans. Linn. Soc. London, vol. 13, p. 256, May, 1821.

[5] Belanger, Voyage aux Indes-Orientales, Zoologie, p. 104, 1835.

Geoffroy was naturally quite unaware of the existence of Ellis's manuscript notes and drawings. Since Diard's and Raffles's time the group has become better and better known and its geographic range widely extended. The most important discoveries in regard to the group since 1821 have been the announcement of the genus *Ptilocercus* by Gray,[1] 1848, of the group now called *Dendrogale* by Schlegel and Müller,[2] the discovery of treeshrews in the Philippine Islands by Whitehead, about 1879,[3] now forming the genus *Urogale*, and the discovery of treeshrews in India by W. Elliot, about 1849.[4]

DEFINITION AND RELATIONSHIPS.

The Tupaiidæ are diurnal insectivorous mammals characterized by a general squirrel-like aspect, more or less arboreal habits, orbits completely encircled by bone, alisphenoid canal present, malar bone with a more or less enlarged perforation, separate radius and ulna, and separate tibia and fibula, dental formula $I \frac{2}{3}\ C \frac{1}{1}$, $Pm \frac{3}{3}\ M. \frac{3}{3}$, upper molars with typical W pattern. The family is composed of two very distinct groups for a long time regarded as genera, the typical members of the family, *Tupaia* and the aberrant *Ptilocercus*. The old genus *Tupaia* has gradually been seen to be a composite genus, and up to the present time has been divided into three separate genera: *Tupaia*, *Dendrogale*, *Urogale*. In the present paper two more genera are recognized. These genera are now for the first time grouped to form the subfamily Tupaiinæ. The single genus *Ptilocercus* is here regarded as forming the subfamily Ptilocercinæ. *Hylomys* of the Erinaceidæ was formerly associated with the treeshrews, but was removed in 1874 by Anderson.[5]

TUPAIINÆ.	PTILOCERCINÆ.
Tail bushy or close-haired throughout its entire extent.	Tail with terminal portion distichously tufted, naked, and scaly basally.
Ears small and cartilaginous.	Ears large and membranaceous.
Footpads of moderate development.	Footpads relatively large and soft.
Supraorbital foramen well developed.	Supraorbital foramen absent.
Foramen rotundum entirely distinct from sphenoidal fissure.	Foramen rotundum confluent with sphenoidal fissure.
Second upper incisor unicuspid.	Second upper incisor with a distinct posterior cusp.
Upper molars with well-developed bifurcated mesostyles.	Upper molars without mesostyles.
Upper molar teeth without a distinct cingulum.	A distinct cingulum encircles the upper molar teeth.
Lower molar teeth without a cingulum.	Lower molar teeth with a cingulum on outer surface.

[1] Proc. Zool. Soc. London, 1848, p. 23.
[2] Verh. Nat. Gesch. Nederl. Overz. Bezitt., p. 167, 1839–44.
[3] Thomas, Ann. Mag. Nat. Hist., ser. 6, vol. 9, p. 250, March, 1892.
[4] Waterhouse, Proc. Zool. Soc. London, 1849, p. 107.
[5] Trans. Zool. Soc. London, vol. 8, 1874, pp. 453–467.

Genera and their types.	Genus and its type.
Tupaia RAFFLES, 1821, *Tupaia ferruginea.*	*Ptilocercus* GRAY, 1848, *Ptilocercus lowii.*
Anathana, new, *Tupaia ellioti.*	
Dendrogale GRAY, 1848, *Tupaia murina.*	
Tana, new, *Tupaia tana.*	
Urogale MEARNS, 1905, *U. cylindrura* (= *T. everetti.*)	

The nearest relatives of the Tupaiidæ are the Macroscelididæ, terrestial Insectivores of Africa. Many authors [1] place the two families in a superfamily or subordinal group, the Menotyphla or Tupaioidea as distinguished from all the other living Insectivores the Lipotyphla.

This grouping appears to me to be a natural one, and the differences that we now find between the Tupaiidæ and the Macroscelididæ are in large measure due to the very different modes of life of the two families, the Tupaiidæ being quite arboreal in their habits, and the Macroscelididæ, terrestrial and saltatorial. The geographic distribution of the two families taken together show many resemblances to the present day distribution of the Tragulidæ, rhinoceroses, elephants, anthropoid apes, Cercopithecidæ, and Megachiroptera, a circumstance lending some weight to their probable common origin. In spite of their great difference there is scarcely an osteological structure in the Macroscelididæ that does not have some counterpart in the Tupaiidæ, and the opposite, the most conspicuous difference being the absence of the alisphenoid canal in the former and its presence in the latter, and the complete bony orbit of the Tupaiidæ absent in the African family. The skull of the Macroscelididæ bears most general resemblance to that of *Ptilocercus*, and it is interesting to note that a supraorbital foramen is lacking in both, but is a conspicuous feature of the Tupaiinæ. The main differential points between the two families are seen in the following table:

TUPAIIDÆ.	MACROSCELIDIDÆ.
Alisphenoid canal present.	Alisphenoid canal absent.
Supraorbital foramen present (except in *Ptilocercus*).	Supraorbital foramen absent.
Orbit completely surrounded by bone.	Orbit not completely surrounded by bone, even postorbital processes lacking.
Radius and ulna separate bones.	Radius and ulna fused.
Tibia and fibula separate bones.	Tibia and fibula fused.
Metatarsals not unusually elongated.	Metatarsals unusually elongated.
Premolars, 3 above and 3 below.	Premolars, 4 above and 4 below.
Molars, 3 above and 3 below.	Molars, 2 above and usually 2 below (sometimes 3 below).[2]

[1] Weber, Die Säugetiere, 1904, p. 377. Gregory, Bull. Amer. Mus. Nat. Hist., vol. 27, 1910, p. 268. Gill, Bull. Geol. Geogr. Surv. Terr., No. 2, ser. 2, May 14, 1875, p. 20. Osborn, Age of Mammals, 1910, p. 522.

[2] See Gregory, Bull. Amer. Mus. Nat. Hist., vol. 27, 1910, pp. 280–285; also Thomas (Proc. Zool. Soc. London, 1890, pp. 445, 446) who remarks on dentition of *Petrodromus* and the other genera.

Although the general appearance of the molariform teeth of the Macroscelididæ is quite different from the typical W-patterned teeth of the Tupaiidæ, yet it is easy to see how the teeth of the former may have been derived from those of the latter. The teeth of the Macroscelididæ show a greater departure from the more typical tritubercular teeth of the Tupaiidæ, just as the limb bones have shown a greater departure from the normal.

OSTEOLOGY.

The skeleton of the Tupaiidæ, as represented by the genera *Tupaia* and *Tana*, has been rather carefully studied by Blainville,[1] Mivart,[2] Anderson,[3] and Gregory.[4] In the British Museum is most of the skeleton of the type of *Urogale everetti*, and in the Leyden Museum is a skeleton of *Ptilocercus*. I have not seen the latter, but Jentink[5] has published a few notes on it. It is the only skeleton of that genus that I know of existing in museums. I have not seen skeletons of the genera *Anathana* or *Dendrogale*, and know of none in collections. Skeletons of Tupaia are found in most of the larger museums, and in the United States National Museum are the following:

Cat. No. 124317, *Tupaia glis ferruginea*, Singapore.
Cat. No. 174609, *Tupaia demissa*, Sumatra.
Cat. No. 49468, *Tupaia lacernata wilkinsoni*, middle of Malay Peninsula.
Cat. No. 111782, *Tupaia nicobarica nicobarica*, Great Nicobar Island.
Cat. No. 154593, *Tupaia javanica*, western Java.
Cat. No. 174611, *Tana tana tana*, Sumatra.

The observations on the skeleton which follow are based upon an examination of these skeletons of the genera *Tupaia* and *Tana* and skulls of the other genera. I have also made free use of the observations of Mivart, Anderson, and Gregory.

Skull.—The skull of the genus *Tupaia* is characterized by its rather generalized structure; it is widest just posterior to the middle, and tapers toward either extremity both laterally and supero-inferiorly, the tapering being much more pronounced anteriorly, especially so in the genera *Tana* and *Urogale;* posteriorly the skull is gently rounded off. The brain case is relatively large and inflated and widest at the zygomatic roots. The orbit is completely surrounded by bone, is large, directed mainly laterally but at the same time slightly inclined upward and forward. Posterior to the orbit is a temporal fossa of moderate size. The temporal ridges are rather prominent and distinct except for a short distance in front of the lambdoid crest, where they unite to form a short sagittal crest. In *Ptilocercus* the temporal

[1] Ostéog. Mamm. Insect., 1840, pp. 31–35.
[2] Journ. Anat. Physiol., vol. 1, 1867, pp. 292–295, and vol. 2, 1868, pp. 145–146.
[3] Zool. Res. West. Yunnan, 1879, pp. 108–123.
[4] Orders of Mammals, Bull. Amer. Mus. Nat. Hist., vol. 27, 1910, pp. 269–280.
[5] Notes Leyden Museum, vol. 7, 1885, p. 7.

ridges remain separated and in *Urogale* they unite early to form a much more conspicuous sagittal crest than they do in *Tupaia*. The lambdoid crest is well marked and gently arched. It begins faintly on either side near the external auditory meatus and becomes well developed along the upper border of the supraoccipital. The palate is long but neither specially wide nor specially narrow. In front are well marked anterior palatine foramina; posteriorly the palate is slightly concave, and ends in a slightly thickened ridge, and a very small blunt median spine. The most anterior part of the posterior edge is about on a line with the posterior edge of the last molars. In the posterior half of the palate in the genera *Tupaia* and *Tana* are usually irregular vacuities. The other genera, *Urogale*, *Anathana*, *Dendrogale*, and *Ptilocercus*, are usually without defects of ossification in the palate. The external pterygoid fossæ are large, short, and wide, formed by the well marked, pointed, and slightly directed inward pterygoid bones, and the pterygoid plate, rather short and triangular, of the alisphenoid. The choanæ are rather wide, and narrower between the pterygoids than anteriorly. The bullæ are of moderate size and formed of the endotympanic. The outer edge of the bulla is produced outward so as to cover up or enclose the tympanic ring or ectotympanic. The small foramen ovale is almost covered over by the antero-external edge of the bulla. The glenoid fossa is rather wide and shallow and limited in front and behind by short and inconspicuous anterior and posterior glenoid processes. Only the minutest trace of a paroccipital process is present. The alisphenoid is pierced by an alisphenoid canal. The foramen magnum is directed downward and backward.

The external opening of the infraorbital canal is situated above the second premolar. In *Ptilocercus* the canal is much shorter and its external opening is over the last premolar. The internal opening of the canal lies shortly inside the orbit. The lachrymal canal has its opening in a distinct notch except in *Ptilocercus* and is rather more outside of the orbit than inside of it. Except in *Ptilocercus* there is a conspicuous supraorbital foramen at the upper outer angle of the orbit, continuous with a groove under the edge of the roof of the orbit. Except in *Ptilocercus* the optic foramen is separated from the sphenoid fissure by a narrow spicule of bone, and the foramen rotundum lies at the base of the external pterygoid plate. In *Ptilocercus* the optic foramen is separated from the sphenoid fissure by a broad bridge of bone and the foramen rotundum is blended with the sphenoid fissure. The foramen ovale is situated almost under the antero-outer edge of the bulla except in *Ptilocercus* where the opening of the foramen is plainly visible in front of the bulla. In *Tupaia* and *Tana* the malar is pierced by a large fenestra, in the other genera by a small foramen. The external auditory meatus is

situated under the posterior root of the zygomatic process of the squamosal, and is moderately large. Just within its orifice may be seen the tympanic ring.

The mandible shows no points of special interest. In comparison with the Macroscelididæ the coronoid process is well developed and stands about as high above the condyle, as the condyle does above the angular process. In the Macroscelididæ the condyle is drawn upward as high as the coronoid. *Ptilocercus* has a relatively wider and larger coronoid than the other genera of the Tupaiidæ. A well marked mental foramen is found under the first or second premolars,

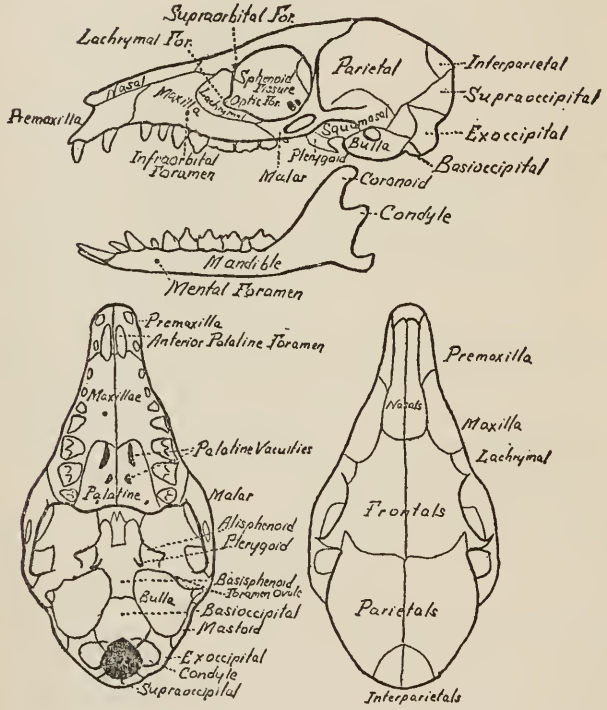


FIG. 1.—DIAGRAM SHOWING THE FORMS AND RELATIONSHIPS OF THE INDIVIDUAL BONES OF THE SKULL OF TUPAIA AS DETERMINED BY EXAMINATION OF YOUNG INDIVIDUALS.

but in *Ptilocercus* the foramen is usually not single and situated slightly more posteriorly.

The relative position and shape of the more important bones of the skull as shown by examination of immature specimens may be seen in figure 1.

Auditory ossicles.—"In the Tupaiidæ the malleus assumes to an extreme degree the neckless and nonlaminated type common in most Cebidæ and some lemurs, as well as in *Sciurus;* but the manubrium is rather of the form prevailing in the above-named primates than

that seen in the squirrels; and so in every respect is the incus. All the ossicula differ from the varied forms in other families of the insectivora, except that the incus somewhat approaches in type that of *Galeopithecus*. Taken as a whole, the ear bones of *Tupaia* are higher in type than in any other family belonging to this order."[1]

Vertebral column—Five skeletons in the United States National Museum have the vertebral formulæ:

Cat. No. 124317, *Tupaia glis ferruginea*, C., 7; D., 13; L., 6; S., 3; C., 24.
Cat. No. 49468, *Tupaia lacernata wilkinsoni*, C., 7; D., 13; L., 6; S., 3; C., 27.
Cat. No. 174609, *Tupaia demissa*, C., 7; D., 13; L., 6; S., 3; C., —.
Cat. No. 111782, *Tupaia nicobarica*, C., 7; D., 13; L., 6; S., 3; C., 28.
Cat. No. 174611, *Tana tana*, C., 7; D., 13; L., 6; S., 3; C., 22.

Certain authors give the lumbar series as 5, 6, or 7.[2] Blainville[3] in the text of Osteography of Mammals says that the number of lumbar vertebræ is seven, but on studying the first plate I can count only six lumbars. By the same author[3] the sacral vertebræ are said to be two, and the caudal 22–23, figures which are confirmed by the plate.

The vertebral formula of *Ptilocercus* is given by Jentink[4] as D. 14, L. 5, S. 3, Cd. 31.

The individual vertebræ are well developed, and with well-defined processes, that is relatively better developed and with better developed processes than in the case of the Macroscelididæ. The first six cervical vertebræ are pierced by vertebral foramina; the atlas is large and relatively heavy, and so is the axis which bears a conspicuous posteriorly directed dorsal spine. On all the other cervical vertebræ dorsal spines are absent or represented by minute projections. As is usual, the under and lateral surface of the sixth cervical is well developed with a prominent costal or pleurapophysial plate. The dorsal vertebræ show no noteworthy peculiarities. The dorsal process on them is rather low and directed backward till the ninth is reached, which has the dorsal process directed upward; the dorsal processes on the three remaining dorsal vertebræ are low and directed forward. The lumbar vertebræ taken as a whole have well-developed anteriorly directed dorsal processes, and still better developed, wide anteriorly directed transverse processes, the processes being smaller on the anterior vertebræ of the series. In Macroscelididæ, represented by a skeleton *Elephantulus roseti*, the transverse lumbar processes are shorter and wider. The sacrum in *Tupaia* and *Tana* is composed of three firmly fused vertebræ, that is, no large foramina exist between the transverse processes of the first and second, and second and third sacrals, as is the case in Macroscelididæ. The first

[1] Doran, Trans. Linn. Soc. London, ser. 2, 1879, vol. 1, p. 444.
[2] See Gregory, Bull. Amer. Mus. Nat. Hist., vol. 27, 1910, p. 275.
[3] Ostéographie des Mammifères, vol. 1, p. 33, pl. 3, lower figure.
[4] Notes, Leyden Museum, vol. 7, 1885, p. 38.

and second sacrals in *Tupaia* are practically devoid of dorsal spines, but the third has a conspicuous one. All three have distinct spines in Macroscelididæ, and that of the first is very large and conspicuous. The sacrum is attached to the ilia by means of the transverse processes of the first sacral vertebra in *Tupaia*, by those of the first and second in Macroscelididæ. The first five caudal vertebræ in *Tupaia* have a neural canal and well-developed transverse processes; in Macroscelididæ it is only the first three.

Ribs and sternum.—There are 13 pairs of ribs in *Tupaia*, of which the first 8 are attached along their ventral border directly to the sternum, the seventh and eighth reaching the sternum together, where the xiphoid segment of the sternum is attached to the fifth mesosternal segment. The ventral ends of the last two pairs of ribs are entirely free, while the ventral ends of the ninth, tenth, and eleventh ribs are attached to the costal cartilages of one another and to that of the eighth rib.

The sternum consists of a large well developed manubrium, the anterior extremity of which is largely expanded, as is usual in mammals with a well developed clavicle, and relatively better developed than it is in Macroscelididæ. The manubrium is followed by five narrow mesosternal segments, and these in turn by the narrow xiphisternum ending in a rather distinct flat rounded piece of cartilage. In Macroscelididæ there are only four distinct and very wide mesosternal segments, and the posterior extremity of the xiphisternum is forked.

Shoulder girdle.—The clavicle is well developed in *Tupaia*, articulating at one extremity with manubrium of the sternum and at the other with the acromion process of the scapula. It appears to be relatively as well developed in Macroscelididæ.

The scapula presents no special peculiarities; its shape may be seen from an examination of plate 2. It possesses a flat wide acromion process and a short blunt metacromion. The coracoid process is well developed. The spine of the scapula is relatively much longer in Tupaiidæ than in Macroscelididæ, and conversely the acromial process relatively shorter.

Pelvis.—All three bones of the pelvis are well developed in Tupaiidæ, the ilia are large and flaring and relatively wide, the tuberosity of the ischium well developed, and the symphysis pubis very long, and the obturator foramen large and oval. In Macroscelididæ the ilia are much narrower, the symphysis relatively shorter, and the obturator foramen more oblique and elongated.

Fore limb.—The humerus is long and well developed and shows no special peculiarities. The deltoid ridge is prominent and begins slightly above the middle of the shaft. A distinct supracondylar foramen is above the internal condyle relatively smaller in Tupaiidæ

than it is in the Macroscelididæ. The radius and ulna are well developed and present as distinct bones, and they and the humerus are subequal in length.

In Macroscelididæ the ulna is intimately fused with the radius and appears but little more than a process at the upper end of the radius. The radius-ulna is much longer than the humerus.

The carpus is composed of a scapho-lunar, cuneiform and pisiform (well developed) proximally, the usual trapezium, trapezoid, magnum, and unciform distally and a distinct os centrale between the two rows.

Hind limb.—The femur is only slightly shorter than the tibia, in Macroscelididæ much shorter. The bone has a well marked head and neck and prominent greater, lesser, and third trochanters.

The tibia is well developed, with a conspicuous ridge in front. The fibula is slender, and perfectly distinct from the tibia, except at the two extremities, where the two bones are in contact, the lower end of the fibula having a distinct surface for articulation with the astragulus. In Macroscelididæ the fibula becomes fused with the tibia slightly above the middle of the bone, and the anterior spine of the tibia is much more pronounced than in Tupaiidæ.

The calcaneum is laterally compressed and narrow and relatively short posteriorly, broad and rather flattened anteriorly. Its posterior portion is relatively much shorter than in the Macroscelididæ. The trochlear surface of the astragulus is relatively wider and much shallower in Tupaiidæ than in Macroscelididæ. The remaining bones of the tarsus, cuboid, navicular, and the three cuneiform bones do not show any special peculiarities in Tupaiidæ. In Macroscelididæ they are all much elongated.

The metatarsals are without special peculiarities. The second, third, fourth, and fifth are all essentially subequal, but among themselves in order of length they stand third, fourth, second, fifth. The first metatarsal is distinctly shorter than the others, but is by no means a short bone like the first metatarsal of Macroscelididæ, in which family the entire first digit is shorter than the second, third, fourth, and fifth metatarsals, which are laterally compressed and much elongated. In Tupaiidæ at the base of the fifth metatarsal is a large unciform process lacking in Macroscelididæ.

There does not seem to be any essential differences between the skeletons of *Tupaia*, *Tana*, and *Urogale*. *Urogale* has relatively heavier and thicker bones than has *Tana*, especially seen in those of legs and feet, and has a higher and much better developed spine on the axis than has either *Tana* or *Tupaia*.

It is not probable that the skeletons of *Dendrogale* and *Anathana* differ essentially from those of *Tupaia* or *Tana*. An examination of a skeleton of *Ptilocercus*, however, would probably reveal differences from the other genera, in correlation with the pronounced cranial and

dental characters. Jentink[1] gives the vertebral formula D. 14, L. 5, S. 3, Cd. 31. He further says: "The ribs are peculiarly broad. The clavicle is well developed; the bones of the forearms and of the hind legs are separate."

TEETH.

The dental formula of the Tupaiidæ is *I.* $\frac{2}{3}$, *C.* $\frac{1}{1}$, *Pm* $\frac{3}{3}$, *M.* $\frac{3}{3}$. The teeth are typically insectivorous and nearly represent the full possible Eutherian dentition; one upper incisor is lacking, and one upper and one lower premolar. As to which of the theoretical teeth are lacking does not seem to me to be a matter of great importance. My own view of the formula is *I.* $\frac{12-}{123}$, *C.* $\frac{1}{1}$ *P.* $\frac{-234}{-234}$, *M.* $\frac{123}{123}$. The reason for considering that the third upper incisor is wanting and not the first is that the third lower incisor is a vanishing tooth and has almost disappeared in *Urogale*. This opinion is the same as that of Gregory.[2] He thinks that in *Ptilocercus* i^3 is lacking and is represented by a minute alveolus. The only reason for assuming *P* $\frac{1}{1}$ are wanting is that at present the most anterior premolar is the smallest of the series, and it seems not unreasonable to assume that at one time it may have had standing in front of it a still smaller tooth; furthermore, all of the premolars are preceded by milk teeth which is usually not the case with the first premolars.

The canines in the family are interesting in that they do not have the form and functions of true canines, but are almost indistinguishable from the premolars. It might with some degree of propriety be said that the ideal number of premolars is present in the family and that the canines are lacking, especially since the canine in *Ptilocercus* and occasionally in the other genera is two-rooted, not a character of canine teeth, and since the canine is situated considerably posterior to the premaxillo-maxillary suture, rather than in or almost in that suture, as in most other mammals. The only exception to this is in *Urogale* where the lower canine has the form and function of a true canine, and although the second upper incisor functions as a canine, yet the canine itself is more caniniform and less premoliariform than is the case in the other genera. The canines are always preceded by milk canines.

For the shape and arrangement of cusps, etc., of the teeth figures on pages 33, 121, 128, 135, 155, and 161 should be consulted. Differences that are useful for purposes of classification will be discussed under each genus.

Eruption of teeth in Tupaiinæ.—The manner and order of eruption of teeth in the subfamily Tupaiinæ shows nothing not commonly seen

[1] Notes Leyden Museum, vol. 7, 1885, p. 38.
[2] Bull. Amer. Mus. Nat. Hist., vol. 27, 1910, p. 271.

in other mammalian groups. The youngest skulls that I have examined have always shown the complete milk dentition, but sometimes the last milk premolar has not been entirely in place. The adult dentition is:

$$\frac{I^1\ I^2 — C^1 — P^2\ P^3\ P^4\ M^1\ M^2\ M^3}{I_1\ I_2 . I_3\ C_1 — P_2\ P_3\ P_4\ M_1\ M_2\ M_3}$$

The youngest dentition seen is:

$$\frac{DI^1\ DI^2\ —\ DC^1\ DP^2\ DP^3}{DI_1\ DI_2\ DI_3\ DC_1\ DP_2\ DP_3}$$

The next teeth to appear are $\frac{DP^4}{DP_4}$, followed by M_1, then M^1, then M_2, M^2, M_3, M^3. All the permanent molars are in place before the milk teeth are shed. The first of those permanent teeth having predecessors to appear in the majority of cases is $\frac{P^4}{P_4}$, the upper and lower seeming to come in about the same time. $\frac{P^2}{P_2}$ appear at nearly the same time as $\frac{P^4}{P_4}$, sometimes just before. $\frac{P^3}{P_3}$ are the last of the permanent premolars to come in, appearing just after $\frac{P^2\ P^4}{P_2\ P_4}$. The canines appear at or about the same time as $\frac{P^4}{P_4}$ or just a little later, arriving with $\frac{P^3}{P_3}$. Of the incisors the lower appear slightly before the upper. I_1 appears about the same time as P_4 and before I^1, and just after I_3. I_2 comes in just after I_1 and I_3. I^2 comes in after all the permanent upper premolars and canines are in place, and is followed by I^1, which is thus the last of the permanent teeth to be in place. By the time the last permanent tooth is in place the molars almost always show slight traces of wear.

The teeth of Tupaiidæ in whole or part have been described and figured by Horsfield,[1] Cuvier,[2] Huschke,[3] Owen,[4] Giebel,[5] and Gregory.[6]

VISCERAL ANATOMY.

The visceral anatomy of Tupaiidæ has been examined by A. H. Garrod in 1875,[7] based primarily on an examination of *Tupaia belangeri* which had just died after living in the gardens of the London Zoological Society nearly two years, supplemented by an examination of *Tupaia splendidula* and *Tana tana* from specimens preserved

[1] Zool. Res. Java, unnumbered plate (*Tupaia*, *Tana*), 1824.
[2] Dents des Mammifères, 1825, p. 60 (*Tupaia*, *Tana*).
[3] Isis, vol. 20, 1827, pp. 758–759, pl. 10.
[4] Odontography, vol. 1, p. 419; vol. 2, pl. 111, fig. 3, 1840–1845 (*Tana*).
[5] Odontographie, 1855, p. 18, pl. 5, figs. 6, 15–18, copied from Horsfield and Owen.
[6] Bull. Amer. Mus. Nat. Hist., vol. 27, 1910, pp. 271, 272, figs. 21, 22 (*Tupaia*, *Ptilocercus*).
[7] Proc. Zool. Soc. London, 1879, pp. 301–305, figs. 1–3, brain.

in alcohol. Nothing unusual or of striking importance was found except that the two specimens of *Tupaia* each possessed a distinct cecum, while the specimen of *Tana* did not.

Cecum.—The presence or absence of a cecum in certain insectivores has been made use of in the superfamily classification of *Tupaia*. Thus Peters [1] grouped the insectivores into those with and without a cecum, in the former group being *Galeopterus*, *Tupaia*, and *Macroscelides*. Gill [2] removed *Galeopterus* as a distinct suborder, and grouped the Tupaiidæ and Macroscelididæ, as the Tupaioidea mainly on the presence of a "large" cecum. Haeckel is said to have proposed the terms Menotyphla for the Tupaiidæ and Macroscelididæ and Lipotyphla for all the other insectivora, terms which have been retained by Weber.[3] Garrod's [4] dissected specimens of *Tupaia belangeri* and *T. splendidula* both showed cecums one-half to three-fourths of an inch in length; *Tana tana* showed no cecum. Chapman [5] states that a cecum is wanting in a specimen of "*Tupaia ferruginea*" from Borneo, as well as in an example of *T. picta*.

All the specimens of *Tupaia* that I have examined possess a small but distinct cecum. Unfortunately, I have not examined the intestinal tract of *Tana tana* and am so unable to confirm Garrod's observations. The specimens in the United States National Museum that I have examined, with length of cecum, are:

	mm.
112660, *Tupaia glis ferruginea*	13
105013, *Tupaia glis ferruginea*	13
124083, *Tupaia belangeri*	12
123989, *Tupaia lacernata lacernata*	10
124698, *Tupaia discolor*	11
121893, *Tupaia chrysogaster*	8.5
111783, *Tupaia nicobarica*	8
144306, *Tupaia siaca*	8

It is not to my mind a "large cecum," and can scarcely have any definite function, being almost as relatively small as the human vermiform appendix.

The Indian genus *Anathana* is said by Anderson [6] to possess a "long and narrow" cecum 1.17 inches in length, that is about 30 mm.

It would not appear that the presence or absence of a cecum is a good character for determining larger groups. The majority of our specimens are so preserved as not to show the soft parts, and the organ being vestigial appears to be absent at times, though as a rule it is present in the majority of the species of *Tupaia*.

[1] Abh. kön. Akad. Wiss. Berlin, 1863, p. 20.
[2] Synopsis of insectivorous mammals, Bull. Geol. Geogr. Surv. Terr., No. 2, ser. 2, May 14, 1875.
[3] Die Säugetiere, 1904, p. 377.
[4] Proc. Zool. Soc. London, 1879, pp. 301-305.
[5] Proc. Acad. Nat. Sci. Phila., vol. 56, 1904, p. 148.
[6] Zool. Res. West. Yunnan, 1879, p. 126.

GEOGRAPHIC DISTRIBUTION.

The Tupaiidæ as a whole range from India on the west to and including Mindanao of the Philippine Islands on the east, and from southern China on the north southward to and including Java and the chain of islands off the southwest coast of Sumatra. They are not found eastward of Java, nor on the Celebes, Formosa, Ceylon, or the Andaman Islands so far as known. I know of no specimens or records of the Tupaiidæ on the island of Bali, off the east end of Java and just west of Wallace's Line. It would not be surprising to find them on Bali when the fauna of that island becomes better known. They are found on practically all the smaller islands of the Malayan Archipelago, within the limits just mentioned, and more frequently than not develop geographic races or species on them.

Zoogeographically the distribution of the Tupaiidæ coincides almost perfectly with what is termed the Oriental Region or Realm of Wallace and most zoogeographers, and serves perhaps better than any other family of mammals to define that region. The only areas in this region where they do not occur so far as known are the islands of Ceylon, Formosa, the members of the Philippine Islands, north of Mindanao, and the Andaman Islands.[1] By Wallace, Ceylon is included in a separate subregion of the Oriental Region.

No one genus of the family has a range coextensive with the range of the family.

The genus *Anathana* occupies an area almost coextensive with Wallace's Indian subregion, but so far as our records of specimens show, does not extend quite so far to the north, or with the Sclaters' Indian subregion excepting Ceylon.

The well-marked genus *Urogale* is confined to Mindanao of the Philippine Islands. This group of islands has not been made a subdivision of the Oriental Region, but the Philippine mammals for the most part are so different from their relatives of the rest of the Oriental Region that it would seem advisable to have them constitute a distinct subregion of the Oriental. *Urogale* is thus one of its characteristic genera.

The genus *Tupaia* has the widest geographic distribution of any of the genera in the family, and if we recognize the Philippine Islands as a distinct subregion, it is characteristic of Wallace's Indo-Chinese and Indo-Malayan subregion, or of the Sclaters' Burmo-Chinese and Malayan subregions. The northern of these two subregions is characterized by but a single species group, the *belangeri-chinensis;* while the southern, the Indo-Malayan or the Malayan subregion is characterized by several well-marked species groups. Of the islands in this subregion Borneo is inhabited by the greatest number of

[1] The absence on the Andamans of treeshrews is rather interesting, as they occur on Preparis Island to the north, and on the Nicobars, or at least the southern islands of the Nicobars to the south.

distinct types, among them Tupaias of the *discolor, picta, montana, gracilis* style. Three of these occur on islands to the westward of Borneo; on Banka, *discolor* and *gracilis* types, on Billiton, *gracilis* type, on Karimata, *gracilis* and *montana* types, thus showing the affinities of these islands with Borneo, and not with Sumatra. Of the two species found on Java, a related form of one of them occurs on some of the small islands of the chain off the southern coast of Sumatra, and of the other apparently the same form occurs on one island of the same chain, and in the mountainous region of the southern coast of Sumatra. The intimate relationship of the Malay Peninsula with the island of Sumatra is shown by the occurrence on both of *Tupaia glis ferruginea* and *T. minor malaccana*. Only one well marked group, *minor*, occurs on both Borneo, Sumatra, and the Malay Peninsula. It is not found on Java. On Palawan the Calamianes, and Cuyos Islands, all politically part of the Philippines, but geographically part of Borneo, is found a rather distinct species group without decided affinities to Bornean forms. On the Nicobars occurs one of the most distinct species in the genus, without any apparent relationship to other members of the genus. So far as known no Tupaias are found on the Andaman Islands.

Dendrogale, with two distinct species groups is found on Borneo, with one of the groups occurring also in French Indo-China. This distribution is so peculiar and not paralleled so far as I know by other forms of mammals, that it seems almost certain that the genus will be found elsewhere in the Indo-Chinese and Indo-Malay subregions. Of the form occurring on Borneo and the Asiatic mainland not a dozen examples are in existence in collections, showing that it is a particularly rare animal. See page 131.

The genus *Tana* parallels that of the Orangs in its distribution, being confined to Borneo and Sumatra, and some of the adjacent islands. It contains two well-marked species groups, the smaller of which is known only from Borneo.

To my mind *Urogale* and *Tana* are derived from the same stock form; but *Urogale* on Mindanao being more restricted in area and more remote from the source of origin, probably Borneo, has become the more highly differentiated of the two. *Urogale* must have reached Mindanao from Borneo by way of the Sulu Archipelago. At present there are no records of treeshrews from the islands of the Sulu Archipelago, but in view of the occurrence of *Urogale* on Mindanao it seems likely that treeshrews occur on them and they ought to be of a genus or genera the same as or similar to *Urogale* and *Tana*.

The genus *Ptilocercus* with a single species group is found in Borneo, Sumatra, and southern Malay Peninsula and some of the adjacent islands, and parallels the distribution of *Tupaia minor*.

The following natural divisions or areas of the Oriental, based upon the genera and species found in the family Tupaiidæ, may be recognized. They are not of coordinate importance, nor are all of them mutually exclusive. Those divided up by water seem to be sufficiently distinct, however, to indicate that at some not very remote period connections of some sort may have existed between them.

Indian (excluding Ceylon), genus *Anathana*, and absence of other genera.

Philippine (Mindanao only), genus *Urogale*, and absence of other genera.

Indo-Chinese, the *belangeri-chinensis* group of the genus *Tupaia*, absence of other genera and species. (The distribution of *Dendrogale* is so irregular that I have disregarded it.)

Nicobaran, the well-marked species *Tupaia nicobarica*, absence of other genera and species.

Palawan-Calamine, a fairly well-marked species group of the genus *Tupaia*, absence of other species and genera.

Bornean, a well-marked species group in each of the genera *Dendrogale* and *Tana*, and by four well-marked species groups of the genus *Tupaia*.

Belonging to this subdivision but without all the characteristics are Banka, Billiton, and the Natuna and Karimata Islands.

Sumatran-Peninsular, *glis* group of *Tupaia* and *T. minor malaccana*.

Java-Borussan (apparently including high mountain region of southern Sumatra), two species groups of *Tupaia*, absence of other genera and species.

Sumatra-Bornean, genus *Tana*.

Sumatra-Borneo-Peninsular, genus *Ptilocerus* and the *minor* group of *Tupaia*.

So few Tupaiàs are known from the Rhio-Linga Archipelago that little can be said regarding its affinities. It has both Peninsular and Bornean elements. The rather isolated Tambelan Islands have a single species of genus *Tana*, evidently of Bornean origin, and the isolated Anamba Islands, inhabited only by members of the *splendidula* group of *Tupaia*, also appear to be Bornean in their relations.

GEOGRAPHIC INDEX.

The names of the countries and islands are arranged geographically and not alphabetically.

Islands adjacent to Malay Peninsula:
Mergui Archipelago: *Tupaia belangeri*, p. 59.
Lankawi: *Tupaia lacernata lacernata*, p. 53.
Terutau: *Tupaia lacernata lacernata*, p. 53.
Butang Islands: *Tupaia lacernata raviana*, p. 54.
Penang Island: *Tupaia glis glis*, p. 45.
Perhentian Island: *Tupaia lacernata obscura*, p. 55.
Redang Island: *Tupaia lacernata longicauda*, p. 56.
Tioman Island: *Tupaia glis sordida*, p. 48.
Pemangil Island: *Tupaia glis pemangilis*, p. 48.
Aor Island: *Tupaia glis pulonis*, p. 47.
Singapore Island: *Tupaia glis ferruginea*, p. 41
Batam Island: *Tupaia glis batamana*, p. 46.
Bintang Island: *Tupaia castanea*, p. 90.

Sumatra: *Tupaia glis ferruginea*, p. 41; *Tupaia demissa*, p. 58; *Tupaia siaca*, p. 91; *Tupaia minor malaccana*, p. 114; *Tupaia javanica*, p. 106; *Tana tana tana*, p. 139. *Ptilocercus lowii continentis*, p. 165.

Rhio-Linga Archipelago (between Sumatra and Malay Peninsula):
Batam Island: *Tupaia glis batamana*, p. 46.
Bintang Island: *Tupaia castanea*, p. 90.
Linga Island: *Tupaia minor malaccana*, p. 114; *Tana lingæ*, p. 145.
Sinkep Island: *Tupaia phœura*, p. 49; *Tupaia minor sincipis*, p. 115.

Borussan Islands, along southern coast of Sumatra:
Banjak Islands: *Tupaia tephrura*, p. 50; *Tana tana tuancus*, p. 145.
Nias Island: *Tupaia javanica*, p. 106.
Batu Islands:
Pinie: *Ptilocercus lowii continentis*, p. 165.
Tana Bala: *Tana cervicalis cervicalis*, p. 147.
Tana Massa: *Tana cervicalis masae*, p. 148.
Sipora: *Tupaia chrysogaster*, p. 71.
Pagi Islands: *Tupaia chrysogaster*, p. 71.

Java: *Tupaia javanica*, p. 106; *Tupaia hypochrysa*, p. 70.
Borneo: *Tupaia longipes longipes*, p. 76; *Tupaia longipes salatana*, p. 77; *Tupaia montana montana*, p. 94; *Tupaia montana baluensis*, p. 95; *Tupaia picta*, p. 96; *Tupaia gracilis gracilis*, p. 117; *Tupaia minor minor*, p. 110; *Tupaia splendidula*, p. 83; *Dendrogale murina*, p. 129; *Dendrogale melanura melanura*, p. 132; *Dendrogale melanura baluensis*, p. 132; *Tana tana tana*, p. 139; *Tana tana utara*, p. 141; *Tana tana besara*, p. 141; *Tana chrysura*, p. 149; *Tana paitana*, p. 150; *Tana dorsalis*, p. 152; *Ptilocercus lowii lowii*, p. 164.

Islands faunistically related to Borneo:
Laut off southeast corner: *Tupaia minor minor*, p. 110.
Karimata Island, off west coast: *Tupaia carimatæ*, p. 98; *Tupaia gracilis edorata*, p. 118.
Banguey: *Tupaia minor minor*, p. 110; *Tana paitana*, p. 150.
Palawan: *Tupaia palawanensis*, p. 78.
Balabac: *Tupaia palawanensis*, p. 78.
Culion: *Tupaia möllendorffi*, p. 81.
Cuyo: *Tupaia cuyonis*, p. 82.
Natuna Islands:
Sirhassen: *Tana tana sirhassensis*, p. 142; *Ptilocercus lowii lowii*, p. 164.
Bunguran: *Tupaia natunæ*, p. 85.
Laut: *Tupaia splendidula*, p. 83.
Banka: *Tupaia discolor*, p. 73; *Tupaia gracilis inflata*, p. 118.
Billiton: *Tupaia gracilis inflata*, p. 118.

Islands not clearly related to large land masses:

Tambelan Islands: *Tana tana bunoæ*, p. 144.

Anamba Islands:

Siantan Island: *Tupaia chrysomalla*, p. 88.
Jimaja Island: *Tupaia anambæ*, p. 89.
Riabu Island: *Tupaia riabus*, p. 88.

Philippine Islands:

Palawan: *Tupaia palawanensis*, p. 78.
Balabac: *Tupaia palawanensis*, p. 78.
Culion: *Tupaia möllendorffi*, p. 81.
Cuyo: *Tupaia cuyonis*, p. 82.
Mindanao: *Urogale everetti*, p. 157.

MAPS.

On the maps showing the distribution of the various members of the family Tupaiidæ I have endeavored, as far as possible, to indicate the localities mentioned in the text or the tables of measurements and lists of specimens. In a few cases, however, I have been unable to find some of the localities. Most of the maps are somewhat diagrammatic, but that on page 143 is carefully made and shows virtually most of the localities whence specimens of treeshrews have been obtained. In cases where a form is known, but from a single locality the figures indicating the distribution have been limited to the area around that point, where known, from two or three rather separated localities, the distribution figures have been extended to cover the intervening area, the assumption being that the animal will be found there; when known from several scattered areas, or a large land mass, or part of one, the distribution figures have been liberally applied around the whole area. Future explorations will undoubtedly show much wider ranges for many of the forms shown on the maps. On the whole, I have been rather conservative in indicating the distributions, leaving it to the reader to imagine a more extended range. Thus, we know that *Ptilocercus* is found in the Deli-Langkat region, Sumatra, and it has been indicated at that locality only, on the map. There can be but little doubt, however, that it is found elsewhere in Sumatra, but owing to lack of records I have not so indicated it.

FOOD.

Judging by the typically insectivorous nature of the cheek-teeth in Tupaiidæ, the diet of these animals must be largely insects. Many observers say they naturally eat fruit as well. *Ptilocercus* having teeth slightly less insectivorous than the Tupaiinæ, may perhaps have a more varied diet. However, it is a very rare animal and direct observations on living specimens still rarer. The only ones I

recall are those of Schneider,[1] who had a pair alive for some hours. The only food he offered them was bananas, which they did not eat. Of *Tupaia* Cantor [2] says: "The natural food is mixed insectivorous and frugivorous. In confinement, individuals may be fed exclusively on either, though preference is evinced for insects; and eggs, fish, and earthworms are equally relished."

Of the Indian Tupaias Anderson [3] says: "One stomach was full of the imperfectly digested remains of a small yellow ladybird with a sprinkling of the elytra of small beetles. There were also small masses of a jelly-like substance with very fine fibers."

Hardwicke [4] in an introduction to Diard and Duvaucel's account of *Tupaia glis*, says: "A living one was brought to Bengal by a medical gentleman some months ago; it runs about the house tame, but will not allow itself to be caught for close inspection; though at liberty to run out of doors whenever it likes, it shews no disposition to leave its quarters, and evinces some attachment to the family; for whenever strangers enter the house, it shews disquietude by a chattering like noise. It occasions no trouble in feeding, for it is always on the search after insects, and its favorite food seems to be flies, crickets, grasshoppers, and cockroaches."

Jerdon [5] writes of *Tupaia chinensis* at Darjeeling: "It frequents the zone from 3,000 to 6,000 feet, and was said, by the natives, to kill small birds, mice, &c."

Robinson and Kloss,[6] speaking of *Tupaia glis ferruginea*, say: "The diet is very mixed, consisting of ants and other insects, fruits, seeds, and buds."

HABITS.

Cantor [2] writes on the habits of *Tupaia:* "The young of this very numerous species (*T. ferruginea*) in hilly jungle, is easily tamed, and becomes familiar with its feeder, though toward strangers it retains its original mistrust, which in mature age is scarcely reclaimable. In a state of nature it lives singly or in pairs, fiercely attacking intruders of its own species. When several are confined together, they fight each other, or jointly attack and destroy the weakest. A short peculiar tremulous whistling sound, often heard by calls and answers, in the Malayan jungle, marks their pleasurable emotions, as, for instance, on the appearance of food, while the contrary is expressed by shrill protracted cries. Their disposition is very restless, and their great agility enables them to perform the most extraordinary bounds in all directions, in which exercise they spend the

[1] Zool. Jahrb., vol. 23, 1905, p. 84, pl. 1.
[2] Journ. Asiat. Soc. Bengal, vol. 15, 1846, p. 189.
[3] Zool. Res. West. Yunnan, 1879, p, 126.
[4] Asiat. Soc. Bengal, vol. 14, 1822, p. 471.
[5] Mammals of India, 1867, p. 65.
[6] In Thomas and Wroughton, Journ. Fed. Malay States Mus., vol. 4, No. 1, December, 1909, p. 112.

day, till night sends them to sleep in their rudely constructed lairs in the highest branches of trees. At times they will sit on their haunches, holding their food between the forelegs, and after feeding, they smooth the head and face with both forepaws, and lick the lips and palms. They are also fond of water, both to drink and to bathe in."

Raffles says of *Tupaia ferruginea*:[1] "These animals are as tame and sprightly as squirrels. The tame one above mentioned was suffered to go about at perfect liberty, ranged in freedom over the whole house, and never failed to present himself on the breakfast and dinner table, where he partook of fruit and milk." It is also described being diurnal and arboreal. *Tana* is mentioned as being "always found on or near the ground."

Mr. C. Boden Kloss[2] thinks Tupaias are less arboreal than generally accredited. He says: "Of the numerous species of *Tupaia* which I have collected personally *T. longicauda* with *T. nicobarica*, Zelebor, and its subspecies, *T.* (*N.*) *surda* Miller, alone are truly arboreal in habit. As a rule the so-called 'treeshrews' are seen and trapped on the ground, where they live and feed, or, at most, climb occasionally into low bushes; in them the tail is shorter than the head and body length. The above-named animals, which are met with in high trees and have the habits of squirrels, all possess a tail that is considerably longer than the length of head and body."

The collector of *Tupaia chinensis*, reg. Nos. 97.11.2.10, 97.11.2.11, 97.11.2.12, and 97.11.2.13, British Museum, says: "The four were taken from one nest in a hollow bamboo," one of the few observations on their nests that I know of.

Of *Tupaia glis ferruginea*, Robinson and Kloss[3] remark: "The popular name of 'treeshrew' for these animals is hardly descriptive of their habits, as, in the majority of species, at any rate, it is quite exceptional to see one anywhere than on the ground, among the roots of trees or on low bushes. The jungle near Changi, Singapore, was an exceedingly good trapping ground, and out of 70 or 80 traps set every night hardly one was found unsprung or without an occupant next morning. Six or seven of these shrews were usually thus captured and many more were shot every day. The nest is found in holes, often in fallen timber."

Regarding the food and habits of *Tupaia glis ferruginea*, as observed on the Malay Peninsula and Singapore, Mr. H. N. Ridley[4] writes: "The common species is very destructive in gardens, as it is almost if not entirely frugivorous. It bites holes in the chocolate pods to

[1] Trans. Linn. Soc. London, vol. 13, 1822, p. 257, May, 1821.
[2] Journ. Fed. Malay States Mus., vol. 4, p. 191, October, 1911.
[3] In Thomas and Wroughton, Journ. Fed. Malay States Mus., vol. 4, No. 1, p. 111, December, 1909.
[4] Natural Science, vol. 6, 1895, p. 28.

eat the pith which incloses the seeds, strewing the latter all over the ground, and even digs up the seeds planted in flower boxes. * * * *Tupaia ferruginea* is more terrestrial in its habits than a squirrel. When alarmed it darts up a tree, but never very high, and turning its head downward utters a series of little scolding grunts, which sound like some one talking at a considerable distance. When a stone is thrown near it, it usually immediately jumps to the ground. It is evidently as yet only half accustomed to an arboreal life. In confinement it is very nervous, dashing about the cage when approached, and it never lives long in captivity." [1]

BREEDING.

Tupaias are evidently able to bear young at practically all times of the year. An examination of the collector's remarks on the labels of specimens shows that 3 individuals were pregnant in January, 1 in February, 1 in March, 3 in June, 1 in July, 2 in September, and 1 in October. Specimens showing distinct signs of nursing or about which the collector remarks "milk in mammæ" are distributed through the year as follows: February, 2; March, 1; April, 1; May, 1; June, 1; August, 1; September, 2; November, 1. December is the only month without a record of pregnancy or breeding. While the number of records is too small to justify any generalizations it would appear that the beginning and the middle of the calendar year are the periods of greatest productivity. (See table, p. 23.)

NUMBER OF YOUNG.

The number of offspring produced at one time by Tupaias probably varies with the species and directly with the number of mammæ common to that species. Two is apparently the usual number, but it is sometimes one (*Tupaia nicobarica surda*, Cat. No. 111785), or as many as four (*T. chinensis* B. M. 97.11.2.10–13). (See table, p. 23.)

Cantor [2] says: "The female usually produces one young; she has four mammæ, the anterior pair of which is situated on the lower lateral part of the chest, the posterior on the side of the abdomen."

Robinson and Kloss [3] note that two young are produced at a birth in *Tupaia glis ferruginea*.

MAMMÆ.

The number of mammæ in *Tupaia* varies from one pair in certain species to three pairs in others. The number is of some importance as a character for certain species or groups of species. Where the mammæ are six they have been designated by Mr. Oldfield

[1] But see specimen dissected by Garrod, living for two years, in London Zoological Society, page 13.
[2] Journ. Asiat. Soc. Bengal, vol. 15, 1846.
[3] In Thomas and Wroughton, Journ. Fed. Malay States Mus., vol. 4, No. 1, p. 112 December, 1909.

Thomas[1] as postaxillary, lateral, and preinguinal. When there are only two pairs of mammæ, the preinguinal pair seems to have disappeared, and when only one pair is present it would appear to correspond with the lateral pair. The number seems to be very constant. The only exceptions to constancy that I have observed are: *Tupaia pemangilis*, Cat. No. 112499, U.S.N.M., where the mammæ are 2–3 = 5, in a group where 2–2 = 4 is normal; *T. chinensis*, No. 26841, Amer. Mus. Nat. Hist., with 4 mammæ instead of 6. Here the postaxillary pair is wanting; both of the remaining pairs are more posteriorly placed than usual, so that the preinguinal pair is really inguinal and the lateral pair almost preinguinal. An alcoholic specimen of *Tupaia belangeri* in Genoa from Mount Mooleyit, Tenasserim, with only two pairs of mammæ, belongs to a group that normally has three pairs.

Dates of pregnant, and of nursing Tupaias.

Cat. No.	Name.	Date.	Collector's remarks or author's observations.	Number of mammæ.
104976	*T. glis ferruginea*	Oct. 9	"Uterus contained one fetus about 2 inches long."	4
113149	do	Sept. 4	"Uterus contained 2 small embryos"	4
115490	do	June 4	"Uterus contained 3 well-grown fetuses"	4
115491	do	July 16	"Uterus contained 3 embryos"	4
112449	*T. glis pulonis*	June 7	"Uterus contained 2 embryos, each ¾ inch long"	4
113149	*T. phæura*	Sept. 4	"Uterus contained 2 small embryos"	4
121752	*T. iephrura*	Feb. 12	Mammæ evidently nursed	4
124143	*T. belangeri*	Jan. 10	"Uterus contained 2 embryos, size of large peas."	6
104364	do	Mar. 10	"Mammæ 6," shows signs of nursing	6
124103	do	Jan. 6	"Uterus contained 2 embryos, size of small hazlenuts."	6
104363	do	Feb. 26	"Mammæ 6, contained milk"	6
125175	do	Jan. 30	"Uterus contained 2 embryos"	4
115608	*T. castanea*	Aug. 11	Mammæ evidently nursed	4
144205	*T. siaca*	Nov. 4	do	4
104714	*T. natunæ*	June 27	"Contained 2 embryos, about 2 inches long"	4
125122	*T. carimatæ*	Sept. 1	Mammæ evidently nursed	4
125121	do	do	do	4
111785	*T. nicobarica surda*	June 27	Uterus contains 1 fetus, 30 mm. long	2
154593	*T. javanica*	May 29	Mammæ evidently nursed	4
121488	do	Apr. —	do	4
121490	do	June 27	do	4
121835	*T. cervicalis*	Feb. 18	"Uterus contained 2 embryos"	4

PELAGE.

There is nothing peculiar in the general characteristics of the pelage of treeshrews.[2] It consists of the usual two sorts of hairs, long straight hairs with their terminal ends having colored rings, and softer, shorter, more wooly hairs, also usually having colored rings distally. The basal portions of both kinds of hairs are uniformly some sort of slate color, except in certain species with more or less ochraceous underparts, where all the hairs of the lower parts are uniformly bright colored throughout. So far as I have been able to ascertain, there is no very distinct seasonal change in pelage, and

[1] Ann. Mus. Civ. Stor. Nat. Genova, ser. 2, vol. 10, p. 920, 1890–91.

[2] For remarks on arrangement and size of hairs, see Meijere, Morph. Jahrb., vol. 21, 1894, p. 398.

the color of the pelage in the two sexes is apparently the same. Change of pelage proceeds from the head downward in a more or less definite line across the body. The dates of specimens which show a distinct changing of the pelage are: February 25, June 4, 7, 29, 30, July 1 (2 specimens), 26, September 4 (2 specimens), 18, 20, 21, 23, October 27, November 5, 12, 14, 21, 26, December 4, 19, 22. The changes accordingly take place mainly during the last half of the calendar year. There is only one specimen undergoing a pelage change during the first five months. The dates of pelage changes are thus not so uniformly distributed throughout the year as are those for the production of young. Marked seasonal changes in color do not appear to exist. There is very little difference in color between the new and the old pelages. Where two pelages exist in the same animal, the newer of them is of course brighter and fresher in color, but, strange to say, nearly always lighter. The lighter color is not due to an excess of light-colored rings on the hairs which may later be worn off, but to a real difference in color or shade between the light rings. One of the most striking examples of this difference in color is seen in the tails of the specimens of *Tupaia inflata* from Billiton. Cat. No. 124985 of that series has a tail with every appearance of an old pelage, and the light areas of the hairs are ochraceous. Cat. No. 124947 of the same series has the light areas of the hairs light buffy in the distal two-thirds, which is in old pelage, and almost whitish in the proximal third, which is distinctly new.

Number of specimens showing changing pelage and evidences of breeding.

	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
Pelage changes	.....	1	.....	.....	.....	5	3	.....	5	1	5	3
Breeding	3	3	1	1	1	5	1	1	4	1	1	.....

ALBINISM AND MELANISM IN TUPAIA.

These anomalies are evidently rare in *Tupaia*. I have seen but one albinistic specimen, British Museum 60.5.4.72, female, Penang Hills. This is partially albinistic as far down as the rump and hind limbs, which with the tail are quite normal in color. The forefeet are also normal in color, and the top of nose and head is less marked with whitish or gray hairs than are the other albinistic areas. A second specimen, also from Penang Hills, B. M. 79.11.21.307, has an irregular white patch about a square centimeter in area over the right shoulder; otherwise it is entirely normal. It is possible that the cream-colored tails of *Tupaia demissa* and *Tana chrysura* may be a form of partial albinism that has become established in certain areas.

I have seen no specimens of Tupaia that suggest anything like melanism, so that the condition probably occurs very rarely, if at all.

FAMILY OR SUBFAMILY NAMES OF TREESHREWS.

Cladobatæ Fitzinger (Sitz. Akad. Wiss. Math. Nat. Wien, vol. 60, 1869, pt. 1, 263). Genera: *Hylomys, Cladobates, Dendrogale, Ptilocercus.*

Cladobatida Haeckel, 1895 (Syst. Phylog. Wirbelth., 1895, p. 593). *Cladobates* or *Tupaja* only genus mentioned.

Cladobatidina Bonaparte, 1838 (Syn. Vert. Syst. in Nuov. Ann. Sci. Nat. Bologna, vol. 2, 1838, p. 111). Used as a division of the Soricidæ, no genera mentioned.

Cladobatina Bonaparte, 1845 (Cat Met. Mamm. Europ., 1845, p. 5). Used as a subfamily of the Soricidæ, no genera mentioned.

Glisoricina Pomel (Arch. Sci. Phys. Nat. Bibl. Univ. Genève, vol. 9, p. 250, November, 1848).

Glisoricinæ Murray (Geog. Hist. Mamm., 1866, p. 319). Under Pomel's arrangement of the insectivora he uses Glisoricinæ as a group name embracing *Hylogale, Sorexglis,* and *Oxygomphius* (fossil).

Tupaiadæ Bell. (Todd's Cyclop. Anat. Physiol., vol. 2, 1839, p. 994). Work not seen.

Tupaiidæ Mivart., 1868 (Journ. Anat. Physiol., vol. 2, 1868, p. 145). Comprising *Tupaia, Ptilocercus, Hylomys.*

Tupaina Gray, 1825 (Thomson's Ann. Philos., vol. 26, November, 1825, p. 339). Used as a probable fifth group of the Talipidæ, with the one genus *Tupaia.*

Tupajidæ Schlosser (Beitr. Paläort. Oester.-Ungarns, vol. 6, 1887, pp. 91, 114). Work not seen.

Tupayæ Peters, 1863 (Abhandl. kön. Akad Wissensch. Berlin, 1863, p. 20). As a group name for *Cladobates, Ptilocercus,* and *Hylogale* (probably intended for *Hylomys*).

Tupayidæ Gill (Arrang. Fam. Mamm. Smiths. Misc. Coll., No. 230, p. 19, 1872). Another spelling of Tupaiidæ Mivart.

NAMES THAT HAVE BEEN PROPOSED FOR TREESHREWS USED IN A GENERIC SENSE, OR NAMES OF ESTABLISHED GENERA TO WHICH TREESHREWS HAVE BEEN ERRONEOUSLY ASSIGNED.

Chladobates.—A typographical error for *Cladobates.* It occurs in Schinz, Naturgeschichte und Abbildungen der Säugethiere, 1824, p. 87. Included species *javanicus, vittatus, tana, ferrugineus.*

Cladobates.—This term was first proposed by Cuvier (Dents des Mammifères, p. 60, pl. 17) in 1825. It is used synonymously with *Sorex-glis,* and was probably considered by him to be more euphonious or more descriptive of the animals. It contained three species—*tana, ferruginea, javanica.* It is thus seen to be a pure synonym

of *Tupaia*. The term was adopted by many subsequent writers as the generic designation of the treeshrews, among them Lesson, 1827; Wagner, 1841; Giebel, 1855; Peters, 1864; Zelebor, 1869; Fitzinger, 1870.

Dendrogale.—Proposed by Gray (Proc. Zool. Soc. London, 1848, pl. 16, p. 23) in 1848 as a genus for the species *Hylogalea murina* Schlegel and Müller. Twelve years later Gray apparently repudiated the name when he described another species as *Tupaia frenata*. Until recent years most authors did not consider *Dendrogale* to be generically distinct from *Tupaia*. Fitzinger, however, used it in 1870, and in 1879 it was employed by Anderson as a full genus. Flower and Lydekker in 1891 did not recognize it, and Trouessart in 1898 gave it only subgeneric rank. In the present paper it is employed as the generic term for a small but well defined group of small treeshrews which have gone under the specific names *murina, frenata,* and *melanura*.

Erinaceus.—Blainville (Ostéographie des Mammifères Insectivores, 1839–1864, p. 112, pl. 6, fig. 1) uses the combination *Erinaceus* (*Glisorex*) *tana*. On page 31 he uses *Glisorex* as a full genus in the combination *Glisorex ferrugineus*. This is the third instance that I know of where treeshrews have been referred to a genus that has not been specially set aside for them. The others are Diard and Duvaucel's reference of them to *Sorex* in 1822, and Ellis's *Sciurus* published in Gray. Blainville's error is so evident that one wonders how he made it.

Gladobates.—A typographical error for *Cladobates*. It occurs in Schinz, Naturgeschichte und Abbildungen der Menschen und der Saügethiere, p. 54. Included species *ferrugineus, javanicus*.

Glipora.—This was originally a manuscript name of Diard, and was published by Jentink in 1888 (Cat. Syst. Mus. Hist. Nat. Pays-Bas, vol. 12, Mammifères, p. 118). The species included in it are *G. leucogaster* (= *Tupaia minor?*), *G. rufescens* = (*Tupaia splendidula?*), and *G. murina* = (*Dendrogale murina*). It is not probable Jentink had any intention of establishing the name of the genus or of the included species, *rufescens* or *leucogaster*. It is thus an accidental synonym of *Tupaia*. *Glipora* does not occur in Palmer's Index Generum Mammalium, 1904.

Glirisorex.—Used by Scudder (Nomenclator Zoolgicus, pt. 2, p. 131) in 1882 probably as an etymologic improvement over Desmarest's *Glisorex*. No species are mentioned. It is of course a pure synonym of *Tupaia* used in a broad sense.

Glisorex.—This name was proposed by Desmarest in a footnote on page 536 of his Mammalogie, 1822, as more euphonious than *Sorexglis*, which he and other authors seemed to think was Diard and Duvaucel's generic designation of the treeshrews. Desmarest, however, does

not use the term in preference to *Tupaia*. *Glisorex* was adopted by Blainville and Owen.

Glisosorex.—Used by Giebel in Odontographie, 1855, page 18. He probably intended to copy the term *Glisorex* from Owen's Odontography. On the same page he uses the term *Cladobates*, evidently thinking it a different genus from *Glisorex* and assigning different dental formulas to the two animals. His knowledge of *Cladobates* appears to be based upon Horsfield's account and figures in Zoological Researches in Java. No species are mentioned under *Glisosorex*, and the term is simply a variant of *Glisorex*.

Herpestes.—Anderson (Zool. Res. West. Yunnan, 1879, p. 132) says: "Diard and Duvaucel's figure [of *Sorex glis*] in the Asiatic Researches (Asiatic Researches, vol. 14, 1822, pl. 9) appears to have been copied in a slightly reduced form into the Calcutta Journal of Natural History (Cal. Journ. Nat. Hist., vol. 2, 1842, p. 456, pl. 13½, fig. 1), where it is regarded as a *Herpestes!*" I have been unable to consult the volume of the Calcutta Journal referred to. In his introduction to Diard and Duvaucel's account Major General Hardwicke says: "It bears most resemblance I think to the genus *Viverra*, particularly to *V. Ichneumon*."

Hylogale.—Proposed by Temminck (Monographies de Mammalogie, p. xix) in 1827 as a substitute for *Tupaia*, which being derived from the native name tupai he considered a "*nom très-vicieux.*" He further remarks, "*Ce changement est dans l'intérêt de la science; il sera sans doute adopté.*" According to Temminck the genus contained three species, which, however, are not mentioned by name. The term as originally written by Temminck never seems to have been adopted by other authors.

Hylogalea.—An emendation of *Hylogale* Temminck, used by Schlegel and Müller (Verh. Nat. Gesch. Nederl. Overs, Bezitt, 1839–44, p. 159) as the proper designation of the treeshrews. It is a pure synonym of *Tupaia*, but included two species which were unknown to Raffles. The forms included by Schlegel and Müller are *tana*, *ferruginea*, *javanica*, and *murina*, the last since made the type of the genus *Dendrogale* Gray. Aside from Schlegel and Müller the name does not seem to appear in the literature. In subsequent publications Schlegel adopts the term *Tupaja*.

Ptilocercus.—Proposed by Gray (Proc. Zool. Soc. London, 1848, p. 23) for the very curious animal since then known as *Ptilocercus lowii*. So far as I am aware no other term has ever been proposed for *Ptilocercus*, neither has the animal ever been placed in any other established genus.

Ptilocerus.—A misspelling of *Ptilocercus* found in Wallace's Geographical Distribution of Animals, 1876, vol. 1, p. 337; vol. 2, p. 187; and in Island Life, 1881, p. 345, and in Brehm's Thierleben, 1864, vol. 1, p. 664.

Sciurus.—Used in the manuscript of W. Ellis, 1780, on the third voyage of Captain Cook. Drawing and manuscript in the library of the British Museum, Natural History. This manuscript name was published as *Sciurus dissimilis* in 1860, in the Annals and Magazine of Natural History, third series, vol. 5, p. 71, in an article by Gray.

Sorex.—Employed by Diard in the account of the first described treeshrew, *Sorex glis*, in the Asiatic Journal and Monthly Register, vol. 10, November, 1820, p. 478, also used again by Diard and Duvaucel. (Asiat. Res., vol. 14, 1822, p. 472, pl. 9. This volume was received in London, at the Geological Society, January 10, 1823, and hence was probably published in the third quarter of 1822. Personal communication from C. D. Sherborn.) A careful examination of these works shows that *glis* was described as a new species of the genus *Sorex*. It was not anyone's intention to make a new genus called *Sorexglis*, as certain writers have thought. Palmer in North American Fauna, No. 23, page 636, is of the same opinion that *Sorex glis* was used as a genus and a species, and not as a single name, and so was Horsfield.[1] Desmarest, however, considered it as a generic term and published it as such, *Sorexglis*, and also emended it to *Glisorex*, which was still further emended by Scudder *Glirisorex* and by Giebel as *Glisosorex*.

Sorexglis.—First used by Geoffroy and Cuvier (Hist. Nat. Mamm., vol. 3, liv, 35, December, 1821, p. 1) as a compound word *Sorex-Glis* as a generic designation of treeshrews. No citation of either Raffles or Diard is given, but both are mentioned, and the name is evidently taken from the latter's *Sorex glis*. They discuss the inappropriateness of using barbarous names like *Tupaia*. It is interesting to note that *Tupaia* appeared in May and *Sorexglis* in December of the same year, 1821. Geoffroy and Cuvier included in their genus the species now known as *javanica* and *ferruginea*.

Desmarest was next to use the term, in his Mammalogie, in 1822, in a footnote only, preferring in the text to use the term *Tupaia*.

Sorex-glis is also mentioned by Cuvier in Dents des Mammifères in 1825, although *Cladobates* is adopted as the generic term.

Tapaia.—An accidental renaming of *Tupaia* by J. E. Gray (Ann. Mag. Nat. Hist., ser. 3, vol. 5, 1860, p. 71). The spelling occurs as *Tapaia* in the title, in the body of the article, and in the index. *Tupaia* does not appear in Gray's article, or elsewhere in the volume.

Tupaia.—The earliest generic name for the treeshrews as such proposed by Raffles in May, 1821 (Trans. Linn. Soc. London, vol. 13, 1822, p. 256, May, 1821[2]). It contained two species, *ferruginea* and *tana*. In the present paper *tana* is made the type of a new genus. *Tupaia* is the name adopted by most authors, although it was rejected

[1] Catalogue of the Mammalia in the Museum of the Hon. East-India Company, 1851, p. 130.
[2] See Horsfield, Zool. Res. Java, 1824, p. 2 of text of *Tapirus malayanus*,

by some because of its barbarous origin from tupai the Malay word for any squirrel-like animal, in favor of *Hylogale* or *Hylogalea*, and *Cladobates*.

Tupaia is often written *Tupaja* by German and Dutch authors, and occurs as *Tupaya* in Geoffroy and Cuvier.[1]

Urogale.—Proposed by Mearns (Proc. U. S. Nat. Mus., vol. 28, May 13, 1905, p. 435) for the very peculiar treeshrew from Mindanao, Philippines. The type is *U. cylindrura* Mearns, which in the present paper is considered a synonym of *Tupaia everetti* Thomas. It is one of the most characteristic of all the genera of the Tupaiidæ excepting *Ptilocercus*.

KEY TO GENERA BASED ON EXTERNAL CHARACTERS.

Tail naked for its basal portions, with a distichous tuft of hairs at end.
PTILOCERCINÆ, *Ptilocercus*, p. 159.

Tail haired throughout its whole extent, without a distinct naked basal portion.
TUPAIINÆ.

Tail rounded and close haired for its whole extent.
Hind foot about 30 mm.; snout not unusually long and slender, head usually conspicuously marked ..... *Dendrogale*, p. 126.
Hind foot about 50 mm.; snout long and slender, head without conspicuous markings ..... *Urogale*, p. 154.

Tail clothed with longer hairs, squirrel-like in character.
Snout long and slender, with a naked area on top of nose encroaching backward in middle line into haired area..... *Tana*, p. 134.
Snout not unusually long and slender, with naked area on top of nose not encroaching on haired area, but cut straight across.
Lowerlobe of ear presenting a surface greater than upper half of ear, inner side of ear fairly well haired, reticulations on naked area of nose coarser.
Anathana, p. 120.
Lower lobe of ear presenting a smaller surface than upper portion of ear, inner side of ear scantly haired, reticulations on naked area of nose finer.
Tupaia, p. 30.

KEY TO GENERA BASED ON CRANIAL CHARACTERS.

Supraorbital foramen absent, temporal fossa about equal to orbit in size,
PTILOCERCINÆ, *Ptilocercus*, p. 159.

Supraorbital foramen present, temporal fossa conspicuously smaller than orbit,
TUPAIINÆ.

Fenestra in zygoma small and inconspicuous.
Rostrum much elongated; distance from lachrymal notch to end of premaxilla about equal to distance from notch to occipital condyles..... *Urogale*, p. 154.
Rostrum not conspicuously elongated; distance from lachrymal notch to end of premaxilla much less than distance from notch to occipital condyles.
Distance from lachrymal notch to end of premaxilla equal to distance from notch to auditory meatus; rostrum slender..... *Dendrogale*, p. 126.
Distance from lachrymal notch to end of premaxilla equal to distance from notch to outer pterygoid plate; rostrum heavy..... *Anathana*, p. 120.

[1] Hist. Nat. Mamm., vol. 3, liv, 35, December, 1821, p. 1.

Fenestra in zygoma, conspicuous, elongated, oval in shape.
Rostrum long and slender; premaxillæ elongated; distance from lachrymal notch to end of premaxilla equal to distance from notch to condyles... *Tana*, p. 134.
Rostrum not conspicuously elongated and slender, nor premaxillæ unusually lengthened; distance from lachrymal notch to end of premaxilla equal to distance from notch to auditory meatus ..... *Tupaia*, p. 30.

KEY TO GENERA BASED ON DENTAL CHARACTERS.

Upper molars without mesostyle; upper canine (third tooth in upper jaw) with 2 roots and premolariform in shape; i_2 about twice as large as i_1; middle lower premolar smallest of lower premolar series..... PTILOCERCINÆ, *Ptilocercus*, p. 159.
Upper molars with distinct mesostyle; upper canine (third tooth in upper jaw) usually with a single root, small but somewhat caniniform, i_1 and i_2 almost subequal; first lower premolar smallest of lower premolar series..... TUPAIINÆ.
i^2 much larger than i^1, and caniniform..... *Urogale*, p. 154.
i^2 slightly smaller than i^1, not caniniform.
Hypocones on upper molars much reduced; not present as distinct cusps; lower canines and premolars more trenchant ..... *Dendrogale*, p. 126.
Hypocones on upper molars not conspicuously reduced; present as more or less evident cusps; lower canines and premolars less trenchant.
Hypocones very strongly developed, and pm^4 distinctly wider than long, and c_1 not noticeably higher than adjacent i_3 and pm_2..... *Anathana*, p. 120.
Hypocones moderately developed; pm^4 not conspicuously wider than long; c_1 standing noticeably higher than adjacent i_3 and pm_2.
Lower canine nearer i_3 than to pm_2..... *Tana*, p. 134.
Lower canine equally spaced between i_3 and pm_2..... *Tupaia*, p. 30.

DESCRIPTIONS OF GENERA AND SPECIES.

Genus TUPAIA Raffles.

1820. *Sorex* DIARD, Asiat. Journ. Monthly Register, vol. 10, p. 478, November, 1820. Not of Linnæus 1758.
1821. *Tupaia* RAFFLES, Trans. Linn. Soc. London, vol. 13, 1822, p. 256, May, 1821.
1821. *Sorex-glis* GEOFFROY AND CUVIER, Hist. Nat. Mamm., vol. 3, liv. 35, p. 1, December, 1821, perhaps early in 1822.
1822. *Glisorex* DESMAREST, Mammalogie, footnote, p. 536, 1822.
1825. *Cladobates* CUVIER, Dents des Mammifères, p. 60, pl. 17, 1825.
1827. *Hylogale* TEMMINCK, Monogr. Mamm., p. xix, 1827.
1840. *Erinaceus*, BLAINVILLE, Ostéog. Mamm. Insect., p. 112, pl. 6, fig. 1.
1843. *Hylogalea* SCHLEGEL AND MÜLLER, Verh. Nat. Gesch. Nederl. Overz. Bezitt., p. 159.
1855. *Glisosorex* GIEBEL, Odontographie, p. 18, 1855.
1860. *Sciurus* ELLIS, in Gray, Ann. Mag. Nat. Hist., ser. 3, 1860, vol. 5, p. 71.
1860. *Tapaia* (sic) GRAY. Ann. Mag. Nat. Hist.. ser. 3, vol. 5, 1860, p. 71.
1882. *Glirisorex* SCUDDER, Nomenclator Zool., pt. 2, p. 131, 1882.
1888. *Glipora* JENTINK, Cat. Syst. Mus. Hist. Nat. Pays-Bas, vol. 12, Mammifères, p. 118. Publication of manuscript name of Diard.

Type.—Tupaia ferruginea Raffles. Two species were included in the genus by Raffles—*T. ferruginea* and *T. tana*. The latter is taken as the type of the new genus *Tana*, page 134, and *T. ferruginea* is selected the type of the genus *Tupaia*.

Diagnostic characters.—The most generalized member of the family Tupaiidæ, mainly characterized by the absence of the specializations of the other members, such as rostrum not excessively elongated, tail not tufted nor close-haired, teeth without unusual development of hypocones or other peculiarities, head without conspicuous markings.

External characters.—The external form of *Tupaia* is exceedingly squirrel-like. The natives make no distinction in name between tupaias and squirrels, calling both *tupai*. Collectors observe it is sometimes impossible to say whether a squirrel or tupaia has been shot until the specimen is picked up. Even experienced workers in museums now and then confuse a tupai skin with a squirrel skin. Aside from the shrew-like snout of *Tupaia*, a character which is not usually obvious in the average skin, the genus is quickly distinguished from *Sciurus* by the absence of the long black whiskers or vibrissæ. From the other members of the family *Tupaia* is distinguished by its relatively small ears, finely reticulated naked area of nose, not encroaching on haired area of nose, well-haired tail, lack of face markings. A more or less distinctly defined oblique shoulder stripe present. Mammæ vary from one to three pairs. For the number and arrangement of the footpads see fig. 3, page 32.

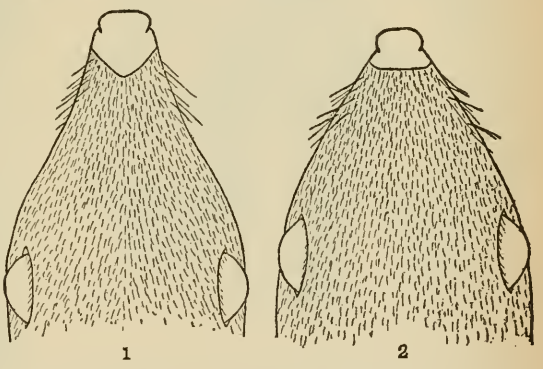


FIG. 2.—DIAGRAM ILLUSTRATING THE RHINARIUM (1) IN THE GENERA TANA AND UROGALE AND (2) IN THE GENERA TUPAIA, ANATHANA, AND DENDROGALE. ABOUT NATURAL SIZE.

Cranial characters.—Rostrum moderately short and heavy; distance from the lachrymal notch to end of premaxilla is about equal to the distance from the notch to the region of the external auditory meatus; in some species the posterior leg of the dividers falling behind the opening, and in others in front of it. In the group containing the species *Tupaia minor* and *gracilis*, the rostrum is particularly short and stubby and the posterior leg of the dividers reaches to about the end of the pterygoid processes. In the species *T. chrysogaster* the rostrum is very slender, but not so much elongated, and the skull as a whole strongly suggests that of the genus *Tana*. The width of the braincase usually approximately equals the length of maxillary toothrow, or exceeds it a trifle in most species; in some of the smaller members of the genus it exceeds it by as much as 3 or 4 mm. Fenestra in zygoma, large and conspicuous, elongated oval in shape; a distinct supraorbital foramen present; temporal fossa distinctly smaller than orbit. (Fig. 4, page 33.)

Dental characters.—The teeth of *Tupaia* are the most generalized of any genus in the family. The two pairs of upper incisors are usually subequal, although the first is nearly always a little the larger. In certain species *T. nicobarica, T. javavica, T. minor, T. gracilis,* however, there is a marked difference in size, but it is always the first pair which is the larger of the two. This difference in size is fairly useful as a group character, but can not be relied upon as a hard and fast one, as specimens showing intermediate degrees of development are found. There are three pairs of lower incisors, all well developed

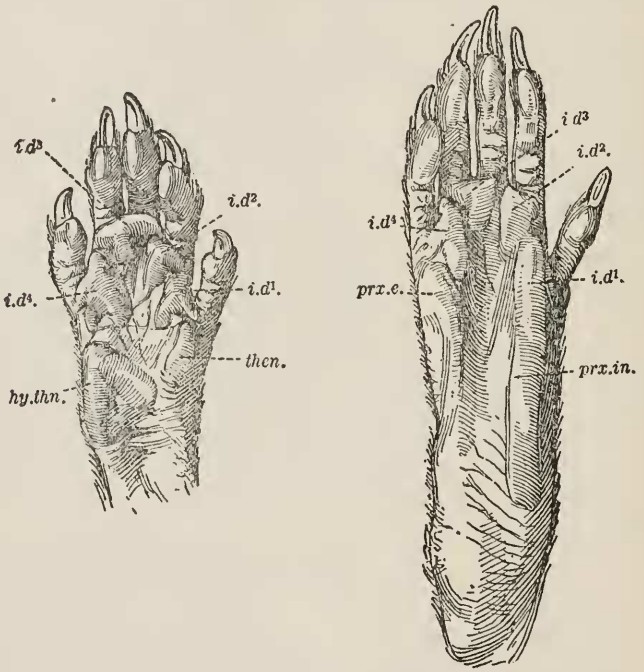


FIG. 3.—PALMAR SURFACE OF RIGHT FOREFOOT AND PLANTAR SURFACE OF RIGHT HINDFOOT OF TUPAIA GLIS FERRUGINEA. CAT. NO. 124319, U. S. N. M., SINGAPORE. ENLARGED ABOUT TWICE. AFTER GREGORY, BULLETIN AMERICAN MUSEUM OF NATURAL HISTORY, VOL. 27, 1910, P. 270. *Hy. thn*, HYPOTHENAR PAD; *i. d*¹, *i. d*², *i. d*³, *i. d*⁴, FIRST, SECOND, THIRD AND FOURTH INTERDIGITAL PADS; *prx. e*, PROXIMAL EXTERNAL PAD; *prx. in*, PROXIMAL INTERNAL PAD; *then*, THENAR PAD.

and functional, but the third pair is much smaller than the others; the second pair is somewhat larger than the first pair. In some cases the third pair is relatively more reduced in size than in others, and in these cases the tooth is barely functional. This is particularly so in those species which have the greatest development of the central upper incisors and is also correlated with a greater development of the lower canine. In this connection it is interesting to note that in the genus *Urogale* where the third lower incisors are quite rudimentary we find a very unusual development of the lower canine, and of the second

pair of upper incisors and not of the first pair, as seems to be the tendency in the genus *Tupaia*. The upper canine in *Tupaia* is moderately well developed, and usually with only one root, except in certain anomalous cases. Its crown always projects distinctly beyond the level of the adjacent premolar. The lower canine is relatively better developed than the upper and always projects conspicuously above the levels of the adjacent premolar and incisor. In the group of species with the enlarged central incisors and reduced third lower incisor, the lower canine is relatively very much enlarged and stands very high above the mandibular toothrow. At first sight this development of the lower canine appears to be a valuable group character, but one encounters specimens or species where it is quite impossible to decide whether the lower canine is of the enormously developed type or not. Its greatest absolute and relative development occurs in *Tupaia nicobarica*. In the case of *T. cuyonis* it is difficult to say whether the canine is unduly enlarged. There are three pairs each of upper and lower premolars. The first of each are small and almost functionless; the others increase in size and complexity from before backward. The last deciduous premolars have the same form as the typical molars. Upper and lower molars, three pairs of each; the first and second upper molars with the hypocones always present, but rather poorly developed. See fig. 5 above.

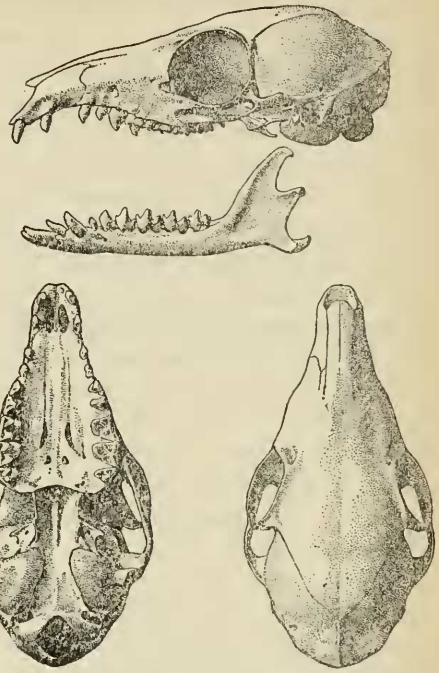


FIG. 4.—TUPAIA GLIS FERRUGINEA, × 1, CAT. NO. 114548. U.S.N.M. TAPANULI BAY, SUMATRA.

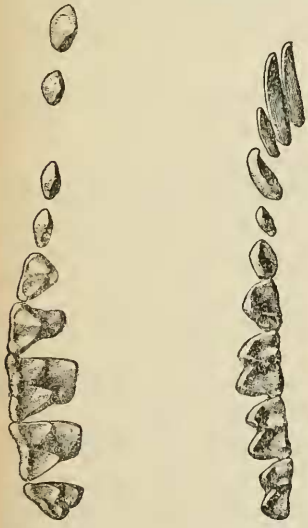


FIG. 5.—TUPAIA GLIS FERRUGINEA UPPER AND LOWER TOOTHROWS × 2½, CAT. NO. 114548, U.S.N.M. TAPANULI BAY, SUMATRA.

A cecum about 10 mm. long is probably one of the generic characters. (See p. 14.)

Geographic distribution.—The genus *Tupaia* has a wider distribution than any of the other genera of the family, ranging on the west from northeastern India, Burma, and Nicobar Islands eastward to members of the Philippine Islands which geographically are extensions of Borneo; on the north from central China south to Sumatra, including islands on the southwest coast, Java, and Borneo. It does not occur on Celebes, nor islands to the east of Java, with the possible exception of Bali, whose fauna is not well known.

Number of forms.—*Tupaia*, the most generalized member of the family contains the largest number of specific and subspecific forms, 48 named forms being recognized in this revision. As a matter of convenience, the genus may be divided into four fairly well-marked sections and each of these into secondary groups and subgroups. I feel sure, however, that the divisions are not natural ones, and it is quite possible in most cases to start with any given subdivision and by means of diverging forms pass into or at least toward some other subdivision. The most strikingly differentiated of the forms are *Tupaia nicobarica* and *T. picta*. The sections, groups, and subgroups, into which the genus may be divided are:

I. Members with the tail longer than head and body, central upper incisors large in comparison with lateral pair, lower canines well developed, and third lower incisor reduced in size, general shape of skull normal. Contains two groups.

1. *Nicobarica* group. Size large, general color brown, black area on lower back; mammæ, 1–1 = 2.

Tupaia nicobarica nicobarica, Great Nicobar Island, page 103.

Tupaia nicobarica surda, Little Nicobar Island, pl. 3, fig. 1; pl. 10, fig. 7, page 104.

2. *Javanica* group, size small, general color olivaceous above and dark below; mammæ 2–2 = 4.

Tupaia javanica, Sumatra, Nias Island, Java, pl. 3, fig. 2; pl. 10, fig. 1, page 106.

II. Members also with the tail longer than head and body, and largely developed central upper incisors and lower canines, but rostrum of skull very short and stubby and brain case relatively inflated, the general shape of the skull being quite atypical. General coloration olivaceous above, light below, mammæ, 2–2 = 4. Contains only one group.

1. *Minor* group. Characters as above.

Tupaia minor minor, Borneo, pl. 3, fig. 3; pl. 10, fig. 3, page 110.

Tupaia minor malaccana, Sumatra, southern Malay Peninsula, and Linga Island, pl. 10, fig. 4, page 114.

Tupaia minor sincipis, Sinkep Island, page 115.

III. Members combining the characters of Section II with those of the next or typical section. The tail is long, the skull has a short stubby rostrum and inflated brain case, like that of Section II, but the teeth do not have unusually developed central upper incisors and lower canines. General coloration olivaceous above, light below. Number of mammæ unknown. Contains but one group.

1. *Gracilis* group. Characters as above.

Tupaia gracilis gracilis, Borneo, page 117.

Tupaia gracilis inflata, Banka Billiton, pl. 10, fig. 2, page 118.

Tupaia gracilis edarata, Karimata Island, page 118.

IV. This section contains the great majority of the members of the genus, the tail is not unusually elongated, the skull has the typical form as in Section I, but the teeth do not show the peculiarity of enlarged central upper incisors and lower canines. Size large or medium, never small. Coloration various. Mammæ, 1–3 pairs. Contains eight fairly well-defined groups.

1. *Chinensis* group. Color generally grayish or olivaceous, without characteristic marks or bright colors; mammæ, 3–3 = 6.

Tupaia chinensis, Southern China, Siam, pl. 8, fig. 1, page 63.

Tupaia concolor, Anam, page 68.

Tupaia modesta, Hainan, page 69.

Tupaia dissimilis, Pulo Condore, pl. 1, page 67.

Tupaia belangeri, Northern Malay Peninsula and southern Burma, pl. 8, fig. 2, page 59.

2. *Möllendorffi* group. General coloration grayish or ochraceous without characteristic marks or bright colors, teeth approaching those of the *javanica* group, section I; mammæ, 2–2 = 4.

Tupaia cuyonis, Cuyo Island, Philippines, pl. 9, fig. 1, page 82.

Tupaia möllendorffi, Culion Island, Philippines, page 81.

Tupaia palawanensis, Palawan Island, Philippines, page 78.

3. *Ferruginea* or *Glis* group. General coloration dark ferruginous, tail various but never clear below except in *T. demissa;* mammæ, 2–2 = 4. For convenience this group may be divided into 2 subgroups, the extremes of which are different enough, but the 2 subgroups practically merge into one another.

a. *Ferruginea* subgroup, typically ferruginous:

Tupaia glis ferruginea, Sumatra, southern Malay Peninsula, pl. 3, fig. 4; pl. 8 fig. 6, page 41.

Tupaia glis glis, Penang Island, pl. 8, fig. 8, page 45.

Tupaia glis batamana, Batam Island, pl. 8, fig. 9, page 46.

Tupaia glis sordida, Tioman Island, pl. 9, fig. 8, page 48.

Tupaia glis pemangilis, Pemangil Island, page 48.

Tupaia glis pulonis, Aor Island, page 47.

Tupaia phæura, Sinkep Island, pl. 9, fig. 7, page 49.

Tupaia tephrura, Batu Islands, pl. 8, fig. 7, page 50.

Tupaia demissa, Sumatra, page 58.

b. Wilkinsoni subgroup, approaching *belangeri* of the *chinensis* group:

Tupaia lacernata wilkinsoni, middle portion of Malay Peninsula, pl. 8, fig. 3, page 52.

Tupaia lacernata lacernata, Lankawi and Terutau Islands, pl. 8, fig. 5, page 53.

Tupaia lacernata raviana, Butang Islands, pl. 8, fig. 4, page 54.

Tupaia lacernata obscura, Great Redang Island, page 55.

Tupaia lacernata longicauda, Perhentian Island, page 56.

4. *Splendidula* group. Color various, usually solid, varying from seal brown to bright ferruginous. Color of underside of tail always clear along the central line at least; mammæ, 2–2 = 4.

Tupaia splendidula, Borneo, pl. 10, fig. 11, page 83.

Tupaia natunæ, Bunguran, Natuna Islands, pl. 10, fig. 12, page 85.

Tupaia lucida, Pulo Laut, Natuna Islands, page 86.

Tupaia chrysomalla, Siantan, Anamba Islands, pl. 10, fig. 10, page 88.

Tupaia riabus, Riabu, Anamba Islands, page 88.

Tupaia anambæ, Jimaja, Anamba Islands, page 89.

Tupaia carimatæ[1], Karimata Island, pl. 10, fig. 6, page 98.

Tupaia castanea[2], Bintang Island, pl. 10, fig. 9, page 90.

Tupaia siaca[2], Sumatra, pl. 10, fig. 8, page 91.

5. *Discolor* group. Underparts rather brightly colored, anterior portion of upper parts ferruginous, posterior olivaceous; mammæ, 3–3 = 6.

Tupaia discolor, Banka Island, pl. 9, fig. 4, page 73.

Tupaia longipes longipes, northern Borneo, page 76.

Tupaia longipes salatana, southern Borneo, pl. 9, fig. 5, page 77.

6. *Hypochrysa* group. Underparts very brightly colored, upper parts darkly olivaceous or brownish; mammæ, 1–1 = 2.

Tupaia hypochrysa, Java, pl. 9, fig. 6, page 70.

Tupaia chrysogaster, Pagi and Nias Islands, pl. 9, fig. 9, page 71.

7. *Montana* group. Entire animal a grizzled dark brownish, often with a well-marked black area on back; mammæ, 2–2 = 4.

Tupaia montana montana, Mount Dulit, Borneo, pl. 9, fig. 2, page 94.

Tupaia montana baluensis, Mount Kina Balu, Borneo, page 95.

8. *Picta* group. Back with a narrow dorsal stripe; mammæ, 2–2 = 4.

Tupaia picta, Borneo, pl. 9, fig. 3, page 96.

Remarks.—*Tupaia* is the most generalized member of the Tupaiidæ and, as would be expected, shows the largest number of distinct forms and the widest geographic distribution. It is easy to see how the other members of the family with the exception of *Ptilocercus* have been derived by relatively slight modifications from *Tupaia*.

[1] Suggests the montana group.

[2] Closer to the ferruginea group than the others.

KEY TO THE SPECIES AND SUBSPECIES OF TUPAIA.

Tail distinctly longer than head and body, lower canine (except in *T. gracilis*) twice the length of the incisor in front of it, and central upper incisors (except *T. gracilis*) very conspiciously larger than lateral pair.

Size large, head and body 180–200 mm., much black on lower back..*T. nicobarica*.

Shoulders and neck bright grizzled ochraceous.

Great Nicobar, *T. n. nicobarica*, p. 103.

Shoulders and neck dull grizzled ochraceous...Little Nicobar, *T. n. surda*, p. 104.

Size small, head and body, 140–150 mm., general color uniformly grizzled olivaceous.

Skull with rostrum of normal shape, not stubby, distance between the two lachrymal notches equals distance from that notch to space between first and second upper incisors, under parts rather dark and grizzled.

Sumatra, Nias, Java, *T. javanica*, p. 106.

Skull with a short stubby rostrum, distance between the two lachrymal notches equals distance from that notch to front of first upper incisor, under parts usually clear whitish or buffy.

Hind foot 30–35 mm., central upper incisors and lower canines well developed, grizzling of upper parts, not unusually fine .....*T. minor*, p. 109.

Tail not conspicuously darker than general coloration of upper parts.

Sumatra, Linga, Malay Peninsula, *T. m. malaccana*, p. 114.

Tail conspicuously darker than general coloration of upper parts.

Rump not distinctly russet in contrast with upper parts.

Borneo, *T. m. minor*, p. 110.

Rump distinctly russet in contrast with upper parts.

Sinkep, *T. m. sincipis*, p. 115.

Hind foot 37–43 mm., central upper incisors and lower canine not unusually developed, grizzling of upper parts very fine .....*T. gracilis*, p. 116.

Hind foot 40 mm. or over, bullæ smaller.....Borneo, *T. g. gracilis*, p. 117.

Hind foot not over 40 mm., bullæ larger.

Upper parts and legs grizzled olivaceous brownish.

Billiton, Banka, *T. g. inflata*, p. 118.

Upper parts and legs grizzled ochraceous brownish.

Karimata, *T. g. edarata*, p. 118.

Tail usually distinctly shorter than head and body, occasionally approximately equal to or slightly longer than head and body, but in that case, lower back without a large black area; central upper incisors not conspicously larger than lateral pair, and lower canine not unusually developed, less than twice the length of the incisor in front of it.

Middle of back with a conspicuous narrow black stripe....Borneo, *T. picta*, p. 96.

Middle of back without a conspicuous narrow black stripe.

Tail not uniformly above and below grizzled blackish and grayish or blackish and ochraceous, if grizzled on upper surface, always showing a clear ungrizzled reddish ochraceous area on either side of central line, when viewed from below.

Tail uniformly above and below, dull cream color..Sumatra, *T. demissa*, p. 58.

Tail various, uniformly tawny above and below, or coarsely grizzled with blackish above, and tawny or ochraceous below, never cream color.

General color of upper parts between seal and walnut brown.

Borneo, *T. splendidula*, p. 83.

General color of upper parts varying from dark hazel or chestnut to bright tawny or ochraceous with or without distinct grizzling.

Upper parts with a fine diffused grizzling of blackish and ochraceous with a tendency toward a dark patch on back.

Karimata Island, *T. carimatæ*, p. 98.

Upper parts without fine diffused grizzling, grizzling absent or else coarse, and without tendency to dark patch on back.

General coloration of head, body, and tail tawny.

Tawny, light and bright.....Laut, Natuna Islands, *T. lucida*, p. 86.

Tawny, dull and darker....Riabu, Anamba Islands, *T. riabus*, p. 88.

General coloration of head and body a mixture of dark ferruginous and blackish.

Under parts ochraceous.....Bintang Island, *T. castanea*, p. 90.

Under parts light or dark buffy, sometimes grizzled.

Under parts bright buffy without grizzling..Sumatra, *T. siaca*, p. 91.

Under parts dull buffy more or less grizzled.

Under side of tail tawny.

Bunguran, Natuna Islands, *T. natunæ*, p. 85.

Under side of tail ochraceous.

Upper parts inclining toward ferruginous.

Siantan, Anamba Islands, *T. chrysomalla*, p. 88.

Upper parts inclining toward ochraceous.

Jimaja, Anamba Islands, *T. anambæ*, p. 89.

Tail uniformly above and below grizzled blackish, and grayish, buffy, or ochraceous, never with a distinct clear area on either side of middle of tail when viewed from below.

First and second upper molars rather quadrate in outline, with distinct hypocones, shoulder stripe obsolete or nearly so, back often marked with with a broad black band.....*T. montana*, p. 93.

Back usually marked with a broad black patch or band.

Mount Dulit, Borneo, *T. m. montana*, p. 94.

Back without a broad black patch.

Mount Kina Balu, Borneo, *T. m. baluensis*, p. 95.

First and second upper molars more triangular in outline and with hypocones poorly developed if at all, shoulder stripe usually fairly well indicated; back never with a broad black band.

Upper parts of body distinctly rusty or ferruginous in color, and if grayish areas are present they are posterior.

Anterior portion of body ferruginous, posterior grayish; mammæ, 3-3=6.

Hind foot less than 50 mm.; difference in color between anterior and posterior portions of back very marked...Banka, *T. discolor*, p. 73.

Hind foot usually 50 mm. or more; difference in color between anterior and posterior portions of back less marked.... *T. longipes*, p. 74.

General effect of lower back and tail bister.

Northern Borneo, *T. l. longipes*, p. 76.

General effect of lower back and tail clove-brown.

Southern Borneo, *T. l. salatana*, p. 77.

Anterior and posterior portions of body of the same ferruginous color.

Under parts dirty white to buffy, never orange rufous; mammæ, 2-2=4. *Ferruginea* group.

Tail brownish, like rest of upper parts in color.

Sinkep Island, *T. phæura*, p. 49.

Tail darker or lighter than rest of upper parts.

Tail black or blackish, seen above.

Palawan Island, *T. palawanensis*, p. 78.

Tail a grizzle of blackish and buffy, seen above.

Hind feet darker than tail, nearly black, a light buffy color predominating at end of tail.. Batu Islands, *T. tephrura*, p. 50.

Hind feet not darker than tail, and a light buffy color not predominating at end of tail.

General color of upper parts brighter, burnt sienna in general effect.

Tail not noticeably grayish, size slightly smaller.

Sumatra southern Malay Peninsula, *T. glis ferruginea*, p. 41.

Tail rather grayish, size slightly larger.

Batam Island, *T. glis batamana*, p. 46.

General color of upper parts duller, a dark mars brown in general effect.

Light colors of under parts inclining toward ochraceous.

Tioman Island, *T. glis sordida*, p. 48.

Light colors of under parts inclining toward buffy or whitish.

Size smaller, hind foot not over 40 mm. and condylobasal length not over 45 mm.

Pemangil Island, *T. glis pemangilis*, p. 48.

Size larger, hind foot over 40 mm. and condylobasal usually over 45 mm.

Color of lower back slightly darker than rest of upper parts ..... Aor Island, *T. glis pulonis*, p. 47.

Color of lower back not noticeably darker than rest of upper parts..... Penang Island, *T. glis glis*, p. 45.

Under parts orange rufous; mammæ, 1–1=2.

Nias and Pagi Islands, *T. chrysogaster*, p. 71.

Upper parts of body not distinctly ferruginous, a grizzle of blackish and various shades of buffy or ochraceous; if ferruginous tints appear they are situated posteriorly.

Under parts orange rufous..... Java, *T. hypochrysa*, p. 70.

Under parts buffy or whitish, or ochraceous.

Mammæ, 3–3=6; ranging from middle of Malay Peninsula northward. *Belangeri-chinensis* group.

Color over lower back more ochraceous or tawny than on upper back.

Northern Malay Peninsula and southern Burma, *T. belangeri*, p. 59.

Color over lower back not essentially different in color from rest of upper parts.

Condylobasal length 50 mm., maxillary, tooth row over 19 mm.

Anam, *T. concolor*, p. 68.

Condylobasal length less than 50 mm. and maxillary tooth row less than 19 mm.

Skull and rostrum narrower, width of brain case 18 mm.

Pulo Condore, *T. dissimilis*, p. 67.

Skull and rostrum not so slender, width of brain case more than 18 mm.

Color darker, especially underparts and legs.

Hainan, *T. modesta*, p. 69.

Color not so dark, underparts whitish and legs often grayish, Southern China and adjacent territory, *T. chinensis*, p. 63.

Mammæ, 2–2=4; ranging from middle of Malay Peninsula southward, and occurring in Philippine Islands.

Hind foot and condylobasal length usually less than 45 mm. and tail not darker than lower back.

Tail distinctly different in color from lower back.
Tail more grayish than back.
Culion Island, *T. möllendorffi*, p. 81.
Tail more blackish than back.
Palawan Island, *T. palawanensis*, p. 78.
Tail approximately of the same general color as lower back.
Rostrum rather short and heavy with an abrupt origin from rest of skull..... Cuyo Island, *T. cuyonis*, p. 82.
Rostrum not unusually short and heavy nor with an abrupt origin from rest of skull.
Great Redang Island, *T. lacernata obscura*, p. 55.
Hind foot and condylobasal length of skull usually exceeding 45 mm. and tail more or less darker than lower back.
Tail conspicuously darker than rest of upper parts.
Size slightly larger, condylobasal length about 47 mm., maxillary tooth row 19 mm. Middle third of Malay Peninsula,..... *T. lacernata wilkinsoni*, p. 52.
Size slightly larger, condylobasal length short, 45 mm., maxillary tooth row 18 mm.
Lankawi and Terutau Islands, *T. lacernata lacernata*, p. 53.
Tail darker than rest of upper parts, but not conspicuously so.
Skull relatively short and wide, general color more olivaceous.
Butang Islands, *T. lacernata raviana*, p. 54.
Skull relatively not so short and wide, general color more ochraceous,
Perhentian Islands, *T. lacernata longicauda*, p. 56.

TUPAIA GLIS (Diard).

(Synonymy, type specimens, etc., under the subspecies.)

Geographic distribution.—Southern third of the Malay Peninsula, and various adjacent islands, and Sumatra.

Diagnosis.—Upper parts a grizzle of a color between ferruginous and chestnut, and blackish, tail a grizzle of buffy and blackish; mammæ, 2–2 = 4.

Color.—Upper parts of head, neck, and body, and outer side of legs a grizzle of ferruginous or chestnut and blackish, tail both above and below a grizzle of buffy and blackish, the black in excess above and the buff below, especially along the middle line; underparts including inner side of legs various shades of buff, often with dark bases of the hairs showing through; feet a fine grizzle of buffy and blackish, the latter color in excess; shoulder stripe of average development, varying from yellow to buff yellow. Often around base of tail and thighs the ferruginous or chestnut color is replaced by an ochraceous tint.

Skull and teeth.—These show no special distinguishing characteristics. The rostrum is relatively long, and the distance from the front of the premaxilla to the lachrymal pit is generally greater than

the distance from the pit to the posterior edge of the external auditory meatus.

Measurements.—*Tupaia glis* is a relatively large species. The usual measurements are: Head and body, 170–200 mm.; tail, 150–175; hind foot, 45–50; condylobasal length, 45–50; zygomatic width, 25–27; width of brain case, 18–21; maxillary tooth row, 17–20.

Subspecies.—Six geographic forms of *Tupaia glis* may be recognized. They are all insular, except *ferruginea* occurring on the Malay Peninsula and Sumatra, but appear so closely allied to one another that it is often impossible to distinguish them one from the other with certainty.

The forms are:

Tupaia glis ferruginea, southern third of Malay Peninsula, Sumatra, page 41.
Tupaia glis glis, Penang Island, page 45.
Tupaia glis batamana, Batam Island, page 46.
Tupaia glis sordida, Tioman Island, page 48.
Tupaia glis pemangilis, Pemangil Island, page 48.
Tupaia glis pulonis, Aor Island, page 47.

Remarks.—*Tupaia glis* is quite a plastic species, as the number of subspecies shows. The next three species, *T. phaeura*, *T. tephrura*, and *T. demissa*, are all geographic forms of *T. glis*, but differentiation has proceeded so much further that their specific distinctness can not be questioned. It is perhaps a slight misfortune that the earliest name applied to the species was given to one of the insular races and not to the real parent form occurring on the large land masses. As a matter of convenience the mainland subspecies is here treated first and most of the comparisons are made with it. The mainland form is the most common in collections and the most convenient to work with.

TUPAIA GLIS FERRUGINEA Raffles.

1821. *Tupaia ferruginea* Raffles, Trans. Linn. Soc. London, vol. 13, 1822, p. 256, published May, 1821.
1821. *Tupaya press* Geoffroy and Cuvier, Hist. Nat. Mamm., vol. 3, livr. 35, p. 1, and *Sorex-Glis press* on p. 2, December, 1821, perhaps early in 1822.
1842. *Cladobates ferruginea*, Cuvier, Hist. Nat. Mamm., vol. 7, Tab. Gen. Meth., p. 2.
1843. *Hylogalea ferruginea*, Schlegel and Müller, Verh. Nat. Ges. Nederl. Overz. Bezitt., p. 163, pl. 26, fig. 3; pl. 27, figs. 7–10.
1879. *Tupaia ferruginea*, Anderson, Zool. Res. West. Yunnan, p. 130, pl. 7, figs. 4 and 5.

Type-locality.—Bencoolen, Sumatra.

Type-specimen.—British Museum Register No. 79.11.21.573, skin and skull of adult male, marked "Indian Mus. Coll. Sumatra, Sir S. Raffles." It is probably one of the specimens from "the woods near Bencoolen." Raffles says: "First observed tame in the house

of a gentleman at Penang, and afterwards found wild at Singapore and in the woods near Bencoolen." The Penang animal was described several months before *ferruginea* under the specific designation *glis*. No specimens collected at Singapore by Raffles are known, so that it is perfectly justifiable to take the above specimen as the type. It has recently been made into a modern study skin and is in fair condition. Some hair has slipped from about the head, legs, and base of tail. The color seems well preserved. The skull is nearly perfect; the occipital region, zygomata, and bullæ being slightly injured.

Geographic distribution.—Malay Peninsula south of about latitude 7½° N., including the island of Singapore; and most of island of Sumatra. For exact localities from which specimens have been examined, see table, pages 43, 44. See No. 6 on map on page 75.

Diagnostic characters.—A bright-colored member of the group, with upper parts of head and body distinctly ferruginous, tail a grizzle of buffy and blackish, rather distinctly different in color from body.

Color.—Upper parts of head, neck, and body, and outerside of legs a grizzle of ferruginous or chestnut and blackish, tail both above and below a grizzle of buffy and blackish, the black in excess above and the buff below, especially along the middle line; underparts including inner side of legs various shades of buff, often with dark bases of the hairs showing through; feet a fine grizzle of buffy and blackish, the latter color in excess; shoulder stripe moderately conspicuous, buffy in color.

Skull and teeth.—These show no special distinguishing characteristics. See plate 8, fig. 6, and figures 4 and 5 on page 33.

Measurements.—Type: Hindfoot, 45 mm; condylobasal length, 51; zygomatic width, 25±; width of braincase, 20; maxillary toothrow, 20. Usual measurements of adults: Head and body, 175–200; tail, 150–175; hindfoot, 42–47; condylobasal length, 47–49; zygomatic width 25–27; width of brain case, 19–20; maxillary toothrow, 18–20. For measurements of all specimens examined, see table, pages 43, 44.

Remarks.—*Tupaia glis ferruginea* has one of the largest areas of distribution of any of the forms in the family, and appears very constant in its characters. I have been able to find no essential differences between specimens from the Malay Peninsula and the island of Sumatra. This case is exactly paralleled by *Tragulus napu.*[1]

An old specimen, British Museum, Register No. 79.6.28.15, collected at Pajo, Sumatra, by Carl Bock, approaches very closely *Tupaia phœura.*

Specimens examined.—Sixty in the United States National Museum, 37 in the British Museum, 1 in the Genoa Museum, 3 in the Berlin Museum.

[1] Miller, The Mouse Deer of the Rhio-Linga Archipelago: A Study of Specific Differentiation Under Uniform Environment, Proc. U. S. Nat. Mus., vol. 37, pp. 1–9, Sept. 1, 1909.

Measurements of Tupaia glis ferruginea.

Locality.	Number.	Sex.	Molar teeth worn.	Head and body.	Tail.	Hind foot.	Condylo-basal length.	Zygomatic width.	Width of brain case.	Maxillary tooth row.	Number of mammæ.
				mm.	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	
Sumatra, Loh Sidoh Bay.	114152	Female	Moderately	190	175	43	48±	25	19±	18.5	2-2
Do	114153	Male	do	190	.....	45	48	24.5	19	18.5	.....
Sumatra, Tarussan Bay.	141074	do	do	200	175	47	49.5	26.5	20	19	.....
Do	141075	do	None[1]	186	175	47	.....	.....	20	19	.....
Sumatra, Tapanuli Bay.	114548	Female	Slightly	195	170	44	47.5	25.5	20	18.5	2-2
Do	114549	Male	Moderately	200	190	47	.....	25	19.5	19	.....
Do	114553[14]	(?)	Slightly	.....	.....	.....	49	26	19.5	18.5	.....
Sumatra, Aru Bay	143328[2]	Male	(3)	205±	155	44	.....	.....	.....	.....	.....
Do	143329	do	Moderately	197	178	47	48.5	26	20	18.5	.....
Do	143330	do	Slightly[4]	200	170	46	.....	24±	.....	19	.....
Do	143331	do	do.[5]	.....	.....	.....	47	24±	.....	18	.....
Do	143332	do	None[1]	200	162	45	46.5	23	19.5	17.5	.....
Do	143333	do	Moderately	190	165	44	48	25	20	19	.....
Do	143334	Female	Slightly	185	175	43	47	25	19	18.5	2-2
Do	143335	do	do	.....	.....	.....	49.5	25	19.5	19.5	.....
Do	143336	do	None[6]	195	160	46	45.5	23±	19.5	18.5	.....
Do	143337	do	do.[1]	170	145	43	.....	23.5	19.5	17.5	.....
Sumatra, Ranau, 3,300 feet.	82.7.28.5	Male	Adult[2]	210	155	46	.....	.....	.....	.....	.....
Sumatra, Pajo	79.6.28.15	.....	.....	.....	.....	45	.....	.....	.....	.....	.....
Sumatra, Bencoolen	79.11.21.573[7]	Male	Moderately	.....	.....	45	51	25±	20	20	.....
Sumatra, Si Rambi.	Genoa[2]	Female	None[8]	150±	125±	45	.....	.....	.....	.....	.....
Sumatra	Berlin, 4059[9]	do	Adult	.....	.....	40	.....	.....	.....	.....	2-2
Johore, Tanjong Peniabong.	112658	do	Much	192	163	45	48	25.5	18.5	19	2-2
Johore, Endau River.	112577	do	Slightly[10]	183	157	44	47	23.5	19	19	2-2
Do	112580	do	Moderately	191	151	45	47	25.5	20	18.5	2-2
Do	112582	do	Slightly[10]	190	143	44	49.5	23	20	19.5	.....
Do	112578	Male	Much	195	155	43	47.5	26	20	19	.....
Do	112579	do	Slightly[10]	200	165	44	49	25	19.5	19	.....
Do	112581	do	do	197	173	45	49.5	25.5	20	19.5	.....
Do	112601	do	Much	189	151	44	47	27.5	20	19	.....
Johore, Sembrong River.	112616	Female	do	203	157	44	50	25.5	19	18.5	2-2
Do	112617	Male	None[11]	185	160	46	.....	24.5	20	19	.....
Johore, Tanjong Silantei.	112662	do	do.[12]	155	.....	43	48	24	19.5	18	.....
Johore, Endau River.	112576	Female	None[13]	.....	.....	.....	41	22	19.5	17±	.....
Johore, Pelepak	143268	Male	Slightly	190	165	47±	49±	26	20	19.5	.....
Do	143269	do	do	185	155	47±	49	25.5	20	19	.....
Johore, Pulai	143270	Female	None[11]	180	170	47	.....	25	19	18	.....
Johore, Endau River.	112575[14]	(?)	Moderately	200	173	.....	48	25.5	20.5	19	.....
Do	112660[2]	Female[15]	.....	170±	130	42	.....	.....	.....	.....	.....
Johore, Tanjong Peniabong.	112659[2]	Male[16]	.....	200±	160	44	.....	.....	.....	.....	.....
Tringanu, Tanjong Dungun.	105024	Female	Slightly	184	165	42	48.5	24.5	19	19	.....
Do	105026	do	do	191	152	43	48	24	20	19	.....
Do	105027	do	do	178	165	43	46.5	24	19.5	18.5	.....
Do	105030	do	do	191	159	43	47	24.5	19.5	18	.....
Do	105031	do	Moderately	190	160	44	47.5	24	19.5	19	.....
Do	105033	do	Much	187	152	44	47.5	25	20	18.5	2-2
Do	105034	do	Slightly	178	146	42	47	23	19	18	.....
Do	105025	Male	Moderately	178	159	44	48.5	24.5	19.5	19	.....
Do	105032	do	do	185	154	43	47	24.5	19.5	19	.....

[1] dpm^3, dpm^4 still in place.
[2] Preserved in alcohol.
[3] Genitalia well developed.
[4] dpm^3 still in place.
[5] dpm^3, dpm^4 still in place, permanent c' just appearing.
[6] m^3 half way up.
[7] Type.
[8] m' last tooth in place.
[9] v. Faber, collector.
[10] pm^4 in place, pm^3 half way up.
[11] dpm^3, dpm^4 not yet shed.
[12] pm^4 nearly in place, dpm^3 still in place.
[13] m^4 just appearing.
[14] Skull only.
[15] About two-thirds grown.
[16] Adult, genitalia well developed.

Measurements of Tupaia glis ferruginea—Continued.

Locality.	Number.	Sex.	Molar teeth worn.	Head and body.	Tail.	Hind foot.	Condylo-basal length.	Zygomatic width.	Width of brain case.	Maxillary tooth row.	Number of mammæ.
				mm.	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	
Tringanu, Tanjong Dungun.	105012[1]	Male	(2)	210±	170	46	.....	.....	.....	.....	.....
Do	105013[1]	...do	(3)	190±	165	44	.....	.....	.....	.....	.....
Pahang, Rumpin River.	115490	Female	Slightly [4]	196	164	46	48.5	25.5	20	18.5	2-2
Do	115491	...do	Moderately	205	163	47	49.5	25.5	19.5	18.5	2-2
Do	115492	...do	None [5]	.....	.....	.....	42	22	20	.....	.....
Selangor, Kuala Lumpur.	152184	Male	Moderately	175	181	46	.....	25±	.....	18.5	.....
Do	152185	...do	.....	190	159	47±	.....	.....	.....	.....	.....
Singapore, Botanic Gardens.	111977, skin only.	Female	.....	171	146	41	.....	.....	.....	.....	.....
Do	111979, skin only.	...do	.....	178	146	42	.....	.....	.....	.....	2-2
Do	105077	...do	None [6]	.....	.....	.....	44.5	23.5	19	18	.....
Do	105078[7]	...do	Slightly	.....	.....	.....	46±	25.5	19.5	19.5	.....
Do	105079[7]	...do	Moderately	.....	.....	.....	45.5	24.5	19	18.5	.....
Do	105080[7]	Male	Slightly	.....	.....	.....	47.5	25	19	18.5	.....
Do	124316[1]	Female	(8)	210±	.....	44	.....	.....	.....	.....	2-2
Do	124317, skeleton.	...do	Moderately	.....	.....	46	49	25	19	19	.....
Do	124318[1]	...do	(8)	200±	.....	41	.....	.....	.....	.....	2-2
Singapore, Island of Changi.	9.4.1.106	Male	Moderately	174	157	45	48	26	19	19	.....
Do	9.4.1.108	...do	...do	192	163	45	49.5	27	19.5	19.5	.....
Do	9.4.1.109	Female	...do	195	160	46	50	26	19	19.5	2-2
Do	9.4.1.107	Male	...do	184	162	44	48	25.5	19	19.5	.....
Do	9.4.1.111	Female	...do	184	158	43	49	25	20	19.5	2-2
Do	9.4.1.110	...do	Slightly	169	154	42	47	24	19.5	18.5	2-2
Do	9.4.1.105	Male	...do	178	156	43	47	25	19.5	19	.....
Singapore, Woodlands.	5.12.7.7	Female	None	179	155	41	.....	25	20	19	2-2
W. Singapore Is.	94.11.28.1[1]	Male	.....	165	140	44	.....	.....	.....	.....	.....
Singapore	5475, Berlin.	(?)	Moderately	.....	.....	41	47±	25	20	19	.....
Gunong Tahan, Pahang, 3,300 feet.	6.10.4.10	Male	Slightly	167	172	45	.....	26	20	19	.....
Do	6.10.4.11	Female	.....	180	153	44	.....	.....	.....	.....	2-2
Pahang River, Kuala Temelong.	6.10.4.12	Male	Much	151	139	42	49	26.5	19	19	.....
Selangor, Ginting Bidai.	10.10.1.15	Female	Moderately	172	164	45	48	25.5	19.5	19	2-2
Do	10.10.1.14	Male	None [9]	145	106	45	.....	.....	19.5	.....	.....
Do	10.10.1.12	...do	Moderately	168	160	44	48	26.5	19	19	.....
Do	10.10.1.13	...do	...do	185	171	47	49.5	27	19.5	19.5	.....
Do	10.10.1.16	Female	...do	195	166	45	.....	26	20	19.5	2-2
Selangor, Telang	85.8.1.93	Male	.....	.....	.....	.....	.....	.....	.....	.....	.....
Johore, Pulai	5.12.7.6	Female	Slightly	177	178	44	49	.....	20	19.5	.....
Johore, Pelepak	5.12.7.3	Male	...do	180	170	45	49	24.5	19.5	19.5	.....
Do	5.12.7.1	...do	...do	180	160	42	48	23.5	19.5	19	.....
Do	5.12.7.2	...do	None [10]	180	150	44	49	24.5	20	19.5	.....
Do	5.12.7.5	Female	Moderately	187	158	43	49.5	25	20	20	2-2
Johore, Boru	5.12.7.4	...do	Slightly	.....	.....	45	.....	25.5	20.5	20	.....
Johore, Si Karang	9.4.1.112	Male	None [11]	171	164	44	47.5	.....	19.5	18.5	.....
Do	9.4.1.113	Female	Slightly	175	161	45	50	25	19.5	20	2-2
Malacca	79.11.21.310	...do	.....	.....	.....	46	.....	.....	.....	.....	2-2
Do	79.11.21.572	.....	None [11]	.....	.....	44	.....	.....	.....	19.5	.....
Do	79.11.21.571	.....	None	.....	.....	44	.....	24	.....	17	.....
Do	79.11.21.689	Female	Much	.....	.....	43	.....	.....	.....	19	2-2
Do	85.8.1.92	.....	None [12]	.....	.....	44	.....	.....	.....	18	.....
Do	85.8.1.91	.....	.....	.....	.....	44	.....	.....	.....	.....	.....
Wellesley Province	79.11.21.688	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Biserat	3.2.6.22	Male	Much	160	164	.....	.....	27	19.5	19.5	.....
Kelantan	9.5.9.1	...do	Moderately	189	152	43	49	26	19.5	19	.....

[1] Preserved in alcohol.
[2] Adult, genitalia moderately developed.
[3] Adult, genitalia well developed.
[4] dpm^3 dpm^4 still in place.
[5] m^1 last tooth in place.
[6] dpm^3 dpm^4 still in place, pm^2 just appearing.
[7] Skull only.
[8] Adult.
[9] I^1 just appearing.
[10] Permanent incisors not in place.
[11] dpm^4 still in place.
[12] di^1 and di^2 still in place.

TUPAIA GLIS GLIS (Diard).

1820. *Sorex glis* DIARD, Asiat. Journ. Month. Reg., vol. 10, p. 478, November, 1820.

1821. *Tupaia ferruginea* RAFFLES, Trans. Linn. Soc. London, vol. 13, 1822, p. 256, published May, 1821.

1822. *Sorex glis*, DIARD and DUVAUCEL, Asiat. Res., vol. 14, p. 472, pl. 9.

1911. *Tupaia ferruginea penangensis* ROBINSON and KLOSS, Journ. Fed. Malay States Mus., vol. 4, p. 242, November, 1911. (Type No. 1445/11, Selangor Museum, collected at Telok Behang, Penang Island, Apr. 2, 1911.)

Type-locality.—Penang Island, off west coast of Malay Peninsula.

There is no type-specimen of *Tupaia glis glis*. Penang is the only exact locality mentioned in the original description, and consequently is regarded here as the type-locality. No mention of its occurring on the Malay Peninsula is made. Of course Diard and Raffles had the same animal in mind in describing their respective species, but the practical results are that *glis* is the name for the Penang animal and *ferruginea* for the Sumatran and peninsular one.

Geographic distribution.—Penang Island. See No. 21 on map on page 75.

Diagnosis.—A slightly differentiated geographic form of *Tupaia glis*, differing in smaller size and a duller paler coloration of the upper parts.

Color.—The general style of coloration of *Tupaia glis glis* is very similar to that of wide ranging *T. glis ferruginea*, but the upper parts of body instead of being a fine grizzle of ferruginous or chestnut and blackish, is a grizzle of rather dark tawny or tawny ochraceous and blackish, while the head and neck are a grizzle of ochraceous buff and blackish. The tail is generally duller in *T. glis glis*. In other respects the two animals are essentially the same.

Skull and teeth.—The skull and teeth of *Tupaia glis glis* are distinctly smaller than those of *T. glis ferruginea*, especially seen in the brain case. (Plate 8, fig. 8.)

Measurements.—The usual measurements of adults: Head and body, 165 mm.; tail, 155; hindfoot, 42–43; condylo-basal length, 47; zygomatic width, 25; width of braincase, 19; maxillary tooth row, 18.5; most of them agreeing with the minimum measurements of *Tupaia glis ferruginea*. For measurements of all specimens examined see table, page 46.

Remarks.—*Tupaia glis glis* is closely related to *T. glis ferruginea* of the neighboring mainland of which it is zoologically a geographic form. Robinson and Kloss were entirely right in describing it as a subspecies of the mainland animal, and it is perhaps a misfortune that *glis* was not originally used for the mainland form, or rather that *ferruginea* was not proposed first, as the latter name has been so long in use that it seems a pity to have it rank as a subspecies.

Specimens examined.—Seven in the British Museum, and two loaned by the Selangor Museum. See table, page 46.

Measurements of Tupaia glis glis.

Locality.	Number.	Sex.	Molar teeth worn.	Head and body.	Tail.	Hind foot.	Condylo-basal length.	Zygomatic width.	Width of brain case.	Maxillary toothrow.	Number of mammæ.
				mm.	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	
Penang Island..	79.11.21.309....	Male....	None [1].....	.....	.....	41	.....	.....	18.5	18	.....
Do.....	79.11.21.307....	...do....	.....do.[2].....	.....	.....	41	45	23	18.5	18	.....
Do.....	60.5.4.72.....	Female..	Moderately..	.....	.....	43	46	25.5	19.5	17.5	.....
Do.....	79.11.21.333....	Male....	None [3].....	.....	.....	42	45	.....	18.5	17	.....
Do.....	60.5.4.71.....	...do....	.....do.....	.....	.....	43	46.5	25	20	18.5	.....
Do.....	79.11.21.308....	...do....	.....do.[4].....	.....	.....	42	43	22	19.5	17.5	.....
Do.....	79.11.21.687....	Female..	Much.....	.....	.....	43	48	25	20	19	2–2
Do.....	S. M. 1442/11[5]	...do....	Moderately..	165	155	42	46	24.5	19	19	2–2
Do.....	S. M. 1444/11..	Male....	.....do.....	163	156	43	47.5	25.5	19	18	.....

[1] i^1 and i^2 just appearing.
[2] i^1 just appearing.
[3] di^1 and di^2 still in place.
[4] m^3 just appearing.
[5] S. M.—Selanger Museum, Federated Malay States.

TUPAIA GLIS BATAMANA Lyon.

1907. *Tupaia ferruginea batamana* Lyon, Proc. U. S. Nat. Mus., vol. 31, p.656, Jan. 16, 1907.

Type-locality.—Senimba Bay, Batam Island, Rhio Archipelago.

Type-specimen.—In United States National Museum, Cat. No. 142151, Senimba Bay, Batam Island, September 15, 1905; collected by Mr. C. Boden Kloss; original number, 2; in good condition.

Geographic distribution.—Batam Island. See No. 18 on map on page 75.

Diagnosis.—A geographic form of *Tupaia glis* having a somewhat grayer tail than has the mainland form *ferruginea* and rather heavier skull and teeth.

Color.—With the exception of its slightly grayer tail and a brighter and more rufescent shade of the upper parts of body, *Tupaia glis batamana* does not differ from typical *T. glis ferruginea.*

Skull and teeth.—The skull and teeth of *Tupaia glis batamana* differ only in their slightly greater size from those of *T. glis ferruginea,* the majority of specimens showing a condylo-basal length of over 49 mm., and a zygomatic width of more than 26, while in the mainland animal only a relatively small number exceed these measurements; the tooth row is 19 mm. or over, and in *T. glis ferruginea* is 19 or under. (Plate 8, fig. 9.)

Measurements.—Type: Head and body, 200 mm.; tail 160; hind foot, 45; condylo-basal length, 50.5; zygomatic width, 27.5; width of brain case, 20; maxillary tooth row, 20. Extreme measurements: Head and body, 180–200; tail, 141–161; hind foot, 43–47; condylo-basal length, 47–51.5; zygomatic width, 26–28.5; width of brain case, 19–20; maxillary tooth row, 19–20.5. See table, page 47.

Specimens examined.—Fifteen, 6 of them preserved in alcohol.

Measurements of Tupaia glis batamana.

Locality.	Number.	Sex.	Molar teeth worn.	Head and body.	Tail.	Hind foot.	Condylo-basal length.	Zygomatic width.	Width of brain case.	Maxillary tooth row.	Number of mammæ.
				mm.	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	
Batam Island, Senimba Bay.	142151 [1]	Female	Slightly	200	160	45	50.5	27.5	20	20	.....
Do	142152	do	Moderately	180	154	43	48.5	26	19	19	.....
Do	143255 [2]	do	do	190	155	44	49.5	27	19.5	19.5	2-2
Do	143256 [2]	do	do	185	150	45	50	26.5	20	20	2-2
Do	143257 [2]	do	do	185	150	43	47	26	19	19	2-2
Do	143252 [2]	Male	Slightly	185	150	47	49.5	27	19.5	19.5	.....
Do	143253 [2]	do	Moderately	190	150	46	49.5	27	19.5	19.5	.....
Do	143254 [2]	do	Much	195	145	44	49.5	27	19	19	.....
Batam Island, Tanjong Turut.	9.4.1.115	do	Moderately	197	158	44	50	28	19.5	19.5	.....
Do	9.4.1.119	Female	Slightly	192	145	44	48.5	27	19	19.5	2-2
Do	9.4.1.116	Male	do	197	161	43	49	26.5	19	19.5	.....
Do	9.4.1.118	Female	Much	194	160	45	50	28.5	20	19.5	2-2
Do	9.4.1.117	Male	Moderately	199	158	45	50	27	19	20	.....
Do	9.4.1.120	Female	Slightly	192	153	47	51.5	26.5	19.5	20.5	2-2
Do	9.4.1.114	Male	do	192	141	47	48.5	27	19.5	19	.....

[1] Type. [2] Preserved in alcohol.

TUPAIA GLIS PULONIS Miller.

1903. *Tupaia pulonis* MILLER, Smiths. Misc. Coll., vol. 45, p. 56, Nov. 6, 1903.

Type-locality.—Pulo Aor, off east coast of Malay Peninsula.

Type-specimen.—In United States National Museum, Cat. No. 112449, skin and skull, adult female, Pulo Aor, June 7, 1901; collected by Dr. W. L. Abbott; original number, 1023; in good condition.

Geographic distribution.—Known only from Pulo Aor, the type-locality. See No. 30 on map on page 75.

Diagnosis.—A geographic race of *Tupaia glis* differing from the mainland animal in being rather duller in color, and tail lighter and more buffy.

Color.—The ferruginous-chestnut color of *Tupaia glis ferruginea* is replaced in *T. glis pulonis* by a color approaching tawny, and in the mixture of buffy and blackish in the tail, the buff is in excess; the under parts and inner side of legs are lighter and nearly cream color. The shoulder stripes are lighter and more conspicuous than they are in *T. glis ferruginea*. The general coloration of the Aor animal is not unlike that of *Tupaia glis glis*, but the under parts and tail are lighter and the general color above more ferruginous.

Skull and teeth.—These do not show any tangible characters by which *Tupaia glis pulonis* can be separated with certainty from related forms.

Measurements.—Type: Head and body, 197 mm.; tail, 175; hind foot, 42; condylo-basal length, 47.5; zygomatic width, 26; width of brain case, 19; maxillary tooth row, 18.5. For measurements of a second specimen, see table, page 51.

Specimens examined.—Two in the United States National Museum.

TUPAIA GLIS SORDIDA Miller.

1900. *Tupaia sordida* MILLER, Proc. Wash. Acad. Sci., vol. 2, p. 231, Aug. 20, 1900.

Type-locality.—Pulo Tioman, off east coast of Malay Peninsula.

Type-specimen.—In United States National Museum, Cat. No. 101747, Pulo Tioman, October 2, 1899; collected by Dr. W. L. Abbott; in good condition.

Geographic distribution.—Pulo Tioman. See No. 28 on map on page 75.

Diagnosis.—Essentially the same in color as *Tupaia glis pulonis*, but under parts darker and more buffy; condylo-basal length slightly less.

Color.—Color of upper parts of head, neck, and body and outer side of legs is not distinguishable from that of *Tupaia glis pulonis;* shoulder stripe less prominent; under parts and inner side of legs dull buff to dull ochraceous buff with considerable of the dark bases of the hairs showing through; underside of tail grayer and less buffy than in the case of *T. glis pulonis.*

Skull and teeth.—These do not show any very tangible differences from those of *T. glis pulonis,* but the condylo-basal length averages about 2 mm. less, and the skull as a whole appears narrower and slenderer, especially when compared with *T. glis ferruginea.* (Plate 9, fig. 8.)

Measurements.—Type: Head and body, 171 mm; tail, 165; hind foot, 40; condylo-basal length, 45.5; zygomatic width, 25.5; width of brain case, 19; maxillary tooth row, 18. For measurements of all the specimens examined see table, page 51.

Specimens examined.—Six in United States National Museum and two in British Museum.

TUPAIA GLIS PEMANGILIS Lyon.

1911. *Tupaia pemangilis* LYON, Proc. Biol. Soc. Wash., vol. 24, p. 168, June 16, 1911.

Type-locality.—Pulo Pemangil, off east coast of Malay Peninsula.

Type-specimen.—In United States National Museum, Cat. No. 112499, Pulo Pemangil, June 12, 1901; collected by Dr. W. L. Abbott; original number, 1064; in good condition.

Geographic distribution.—Pulo Pemangil. See No. 29 on map on page 75.

Diagnosis.—Essentially the same color as *Tupaia glis pulonis*, but hind foot smaller and skull smaller and slenderer.

Color.—The color of *Tupaia glis pemangilis* does not differ from that of *T. glis pulonis.*

Skull and teeth.—The skull and teeth are very similar to those of *Tupaia glis pulonis* and *T. glis sordida,* but the skull is slenderer, slightly shorter; m^3 is smaller; bullæ are slightly smaller.

Measurements.—*Tupaia glis pemangilis* is slightly smaller than the closely related *T. glis pulonis.* External and cranial measurements

of the type: Head and body, 185 mm.; tail, 150; hind foot, 40; condylobasal length, 45; zygomatic width, 23.5; width of brain case, 19; maxillary tooth row, 17.

Specimen examined.—One, the type.

Remarks.—The three forms just enumerated, *Tupaia glis pulonis*, *T. g. sordida*, and *T. g. pemangilis*, are very closely related to one another. These three insular forms are not based on large series and it does not appear improbable that larger numbers might even show that but a single form inhabited the three geographically associated islands of Tioman, Pemangil, and Aor, as the differences separating the three are not greater than are often found in the same form having a greater area of distribution.

TUPAIA PHÆURA Miller.

1902. *Tupaia phæura* MILLER, Proc. Acad. Nat. Sci. Phila., 1902, p. 157, June 11, 1902.

Type-locality.—Sinkep Island, Rhio-Linga Archipelago.

Type-specimen.—In United States National Museum, Cat. No. 113148, skin and skull, adult male, Sinkep Island, September 4, 1901; collected by Dr. W. L. Abbott; original number, 1275; in good condition.

Geographic distribution.—Sinkep Island. See No. 19 on map on page 75.

Diagnosis.—Related to *Tupaia glis ferruginea*, but rather dark and reddish, and with the tail not essentially different in color from rest of the animal. Mammæ, 2–2 = 4.

Color.—*Tupaia phæura* differs in color from *T. glis ferruginea* in having less black mixed in with the ferruginous-chestnut in the region of the neck and shoulders and more black and less grizzling on the lower back and rump. The tail both above and below is a coarse grizzle of black and tawny ochraceous, the black predominating on the upper surface and the tawny ochraceous slightly in excess in the middle line below. When viewed from above the tail is concolor with the rest of the upper parts. The under parts, legs, feet, shoulder stripe, etc., do not differ in color from the corresponding parts of *T. glis ferruginea*.

Skull and teeth.—There are no characters by which the skulls and teeth of *Tupaia phæura* can be distinguished from those of *T. glis erruginea*. (Plate 9, fig. 7.)

Measurements.—Type: Head and body, 195 mm.; tail, 140; hind foot, 44; condylobasal length, 47.5; zygomatic width, 26.5; width of brain case, 19.5; maxillary tooth row, 19. For measurements of 2 other specimens see table, page 51.

Remarks.—*Tupaia phæura* is a very strongly characterized geographic form of *T. glis* and has no close relatives. It is at once dis-

tinguished from *T. glis* and its subspecies by the characters of its tail. It seems curious that with all the large collections made in the Rhio-Linga Archipelago by Dr. W. L. Abbott that on only four islands—Batam, Bintang, Linga, Sinkep—have treeshrews been collected by him: a slightly differentiated form of *T. glis* on Batam, the very distinct *Tupaia phœura* or Sinkep, and on Bintang a member of the *splendidula* group. On Linga and Sinkep occur treeshrews of a very different group (*Tupaia minor*) and genus (*Tana*).

Specimens examined.—Three. See table, page 51.

TUPAIA TEPHRURA Miller.

1903. *Tupaia tephrura* Miller, Smiths. Misc. Coll., vol. 45, p. 57, Nov. 6, 1903.
1909. *Tupaia tephura* (sic), Lyon and Osgood, Bull. U. S. Nat. Mus., 62, p. 250.

Type-locality.—Tana Bala, Batu Islands, off west coast of Sumatra.

Type-specimen.—In United States National Museum, Cat. No. 121752, skin and skull of adult female, Tana Bala Island, February 12, 1903; collected by Dr. W. L. Abbott; original number, 2276; in good condition.

Geographic distribution.—Known only on Tana Bala Island, but probably occurring on other islands of the Batu group. See No. 20 on map on page 75.

Diagnosis.—A dark-colored member of the *Tupaia glis* group of treeshrews, darker than *T. phœura*, but with a distinctly lighter tail. Mammæ 2–2 = 4.

Color.—Compared with *Tupaia glis ferruginea*, *T. tephrura* has a generally darker color effect, the ferruginous tones being deeper and richer, and on the posterior half of the body there is a greater admixture of black; the ferruginous extends further forward, distinctly coloring the top and sides of head. The legs are darker in color than they are in *T. glis ferruginea;* the feet are almost black. The underparts are slightly darker than is usual in *T. glis ferruginea.* The tail is a mixture of black or blackish and buff or buffy; above at the base the black predominates, but for the posterior half the two colors are about equally mixed; on the underside the buffy color in excess, and on either side of the middle line is almost unmixed with blackish, and rather closely approaches the style of tail of the *T. splendidula* group.

Skull and teeth.—The skull and teeth of *Tupaia tephrura* are not essentially different from those of *T. glis ferruginea.* (Plate 8, fig. 7.)

Measurements.—Type: Head and body, 193 mm.; tail, 130 hind foot, 43; condylo-basal length, 48.5; zygomatic width, 25.5; width of brain case, 19.5; maxillary tooth row, 19. See table, page 51.

Remarks.—*Tupaia tephrura* is a well-marked geographic form of *T. glis.* Curiously enough it has many external resemblances to *T. phœura* of Sinkep on the opposite side of Sumatra, but it is distinctly darker and more ferruginous anteriorly, and its tail is buffy

where that of *T. phæura* is tawny ochraceous, and is distinctly different in color from the rest of the upper parts.

Specimens examined.—Two, from Tana Bala.

Measurements of five insular forms of the Tupaia glis group of treeshrews.

Name.	Locality.	Number.	Sex.	Molar teeth worn.	Head and body.	Tail.	Hind foot.	Condylo-basal length.	Zygomatic width.	Width of brain case.	Maxillary tooth row.	Number of mammæ.
					mm	*mm*	*mm*	*mm*	*mm*	*mm*	*mm*	
T. glis pulonis....	Pulo Aor.....	112449 [1]...	Female	Moderately	197	175	42	47.5	26	19	18.5	2-2
Do.....	.....do.....	112448....	Male...	None [2].....	195	190	43	48	26	19.5	19.5	....
T. glis pemangilis.	Pulo Pemangil.	112499 [1]...	Female	Moderately	185	150	40	45	23.5	19	17	2-2
Tupaia glis sordida.	Pulo Tioman...	101746....	...do...	Slightly....	178	140	39	45	24	19	17.5	....
Do.....	.....do.....	101747 [1]...	Male...	Moderately	171	165	40	45.5	25.5	19	18	....
Do.....	.....do.....	104973....	Female	.....do.....	172	152	39	46.5	25	19	17.5	....
Do.....	.....do.....	104974....	...do...	Slightly....	178	146	41	45	24	19	17.5	....
Do.....	.....do.....	104975....	Male...	Moderately	178	152	41	46.5	25	19	18	....
Do.....	.....do.....	104976....	Female	Much.....	189	152	42	46	25	19	18	2-2
Do.....	.....do.....	10.10.1.11.	Male...	Slightly....	187	....	39	46.5	25	19.5	18.5	....
Do.....	.....do.....	8.1.25.4...	Female	Much.....	176	140	40	46.5	25	19.5	18.5	....
T. phæura.....	Pulo Sinkep...	113148 [1]...	Male...	Moderately	195	140	44	47.5	26.5	19.5	19	....
Do.....	.....do.....	113147....	Female	Much.....	185	140	42	46.5	25.5	19.5	18.5	2-2
Do.....	.....do.....	113149....	...do...	.....do.....	195	140	43	47.5	25	19.5	18.5	2-2
T. tephrura.....	Batu Ids.; Tana Bala.	121752 [1]...	...do...	Moderately	193	130	43	48.5	25.5	19.5	19	2-2
Do.....	.....do.....	121751....	Male...	None [2].....	180	150	44	47.5	25	19.5	19.5	....

[1] Type.

[2] Permanent pm^4 half way up.

TUPAIA LACERNATA Thomas and Wroughton.

(Synonymy, type-specimens, etc., under the subspecies.)

Geographic distribution.—The middle third of the Malay Peninsula, and some of the adjacent islands. See Nos. 5, 23, 24, 38, and 39 on map on page 75.

Diagnosis.—Size, skull, and teeth about as in *Tupaia glis*, intermediate in color between *T. belangeri* and *T. glis;* upper parts of head and anterior half of body a grizzle of ochraceous buff and black, of posterior half of body a grizzle of tawny and black, tail generally darker than rest of upper parts; mammæ 2–2 = 4, as in *T. glis*, and not 3–3 = 6, as in *T. belangeri.*

Color.—Upper parts of head, neck, and anterior half of body, including outerside of forelegs, a fine grizzle of ochraceous or ochraceous buff and black, the darker color rather in excess, the general color effect being similar to light raw umber, in certain lights, with an olivaceous cast; upper parts of posterior half of body, including outerside of hind legs, a grizzle of tawny and black, both colors about equally mixed, producing a general color effect of russet, tail above, a coarse grizzle of black and buff, the former color in excess, and the tail as a whole distinctly darker and more blackish than rest of upper parts; underside of tail with the same colors, but the buffy predominating especially in the middle line; under parts of head, neck

and body cream color to dull orange buff, with more or less of the dark bases of the hairs showing through, inner side of legs colored similarly to under parts, but hairs scantier and colors duller; shoulder stripe moderately pronounced, buffy in color.

Skull and teeth.—These do not differ materially from those of *Tupaia glis;* the rostrum is if anything slightly relatively shorter in the more northern animal.

Measurements.—The usual measurements are: Head and body, 175–200 mm.; tail, 150–185; hind foot, 41–46 (less than in *T. glis*); zygomatic width, 24–26; width of brain case, 18.5–20; maxillary tooth row, 17.5–19.5.

Subspecies.—In addition to the mainland form, four insular forms are recognized:

Tupaia lacernata wilkinsoni, middle third of Malay Peninsula, page 52.

Tupaia lacernata lacernata, islands of Lankawi and Terutau, page 53.

Tupaia lacernata raviana, Butang Islands, page 54.

Tupaia lacernata obscura, Great Redang Island, page 55.

Tupaia lacernata longicauda, Perhentian Island, page 56.

Remarks.—As a matter of practical convenience the mainland subspecies is first described, and comparison of the insular races made with it. *Tupaia lacernata* is almost a perfect intermediate so far as color is concerned between *T. glis* and *T. belangeri*. *Tupaia belangeri* is lighter in color and the contrast of its rather tawny rump with the lighter anterior parts of the body more marked; its tail is not so dark. The point of most perfect differentiation, however, is the number of mammæ. Twenty-four females of *T. lacernata* showing developed mammæ have the number 2–2 = 4, while 21 females of *T. belangeri* have the number 3–3 = 6.

TUPAIA LACERNATA WILKINSONI Robinson and Kloss.

1911. *Tupaia ferruginea wilkinsoni* Robinson and Kloss, Journ. Fed. Malay States Mus., vol. 4, No. 2, p. 173, April, 1911.

Type-locality.—Ko-khau, Tarang (also spelled Trang and Trong), Lower Siam.

Type-specimen.—In the Selangor Museum, No. 1138/10, skin and skull of adult male. Ko-khau, Tarang, January 12, 1910. I have not seen this type.

Geographic distribution.—Tarang and extending northward toward southern Tenasserim. See No. 5 on map on page 75.

Diagnosis.—The brightest colored member of the species; rump more tawny, larger than the insular forms except *T. lacernata longicauda;* tail not so blackish as in the forms on the west coast islands, but darker than those on the east coast islands.

Color.—As described above under the species, brighter than any of the subspecies, tail moderately blackish, rump rather tawny; shoulder stripe rather well developed.

Skull and teeth.—Aside from their relatively larger size, the skull and teeth of *T. lacernata wilkinsoni* do not differ essentially from those of the related subspecies. (Plate 2 and plate 8, fig. 3.)

Measurements.—Collector's external measurements taken in the flesh (probably the type but not stated in the description): Head and body, 180 mm.; tail, 175; hind foot, 42; ear, 16. Cranial measurements: Probably the type; greatest length, 51.8; basal length, 44.9; zygomatic breadth, 25.9; cranial breadth, 20.9. Usual measurements of adults: Head and body, 180–195; tail, 150–170; hind foot, 43–45; condylo-basal length, 47–49; zygomatic width, 24–26; width of brain case, 19–20; maxillary tooth row, 18–19. See table below.

Specimens examined.—Nineteen, in the collections of the United States National, British, and Selangor Museums. See table below.

Measurements of Tupaia lacernata wilkinsoni, longicanda, obscura.

Name.	Locality.	Number.	Sex.	Molar teeth worn.	Head and body.	Tail.	Hind foot.	Condylo-basal length.	Zygomatic width.	Width of brain case.	Maxillary tooth row.	Number of mammæ.
					mm	*mm*	*mm*	*mm*	*mm*	*mm*	*mm*	
T. lacernata wilkinsoni.	Tarang, Telibon Island.	83256	Female.	Moderately	....	....	42	45.5	25	19	17.5	2-2
Do	Tarang	83477	Male	...do	191	159	43	49	25	18.5	18.5	....
Do	...do	83254	...do	Much	178	152	43	47.5	26	18.5	18	....
Do	...do	83257	...do	Moderately	178	165	42	45	26	19	16.5	....
Do	...do	86727 [1]	Female.	Adult	215±	165	42	....	....	....	....	2-2
Do	Chong, Tarang.	10.10.1.21	...do	Slightly	168	181	42	44	24	19	17	2-2
Do	...do	10.10.1.20	Male	Moderately	188	172	44	47	24.5	19	19	....
Do	...do	10.10.1.24	Female.	None	166	170	44	47	24	19.5	19	....
Do	...do	10.10.1.22	...do	...do.[3]	161	160	40	....	....	18	....	....
Do	...do	10.10.1.17	Male	Moderately	181	144	42	47.5	26	20	18.5	....
Do	...do	10.10.1.18	...do	Slightly	179	141	43	46.5	24	19.5	19	....
Do	...do	10.10.1.19	Female.	Moderately	181	162	41	48	25	19	19	2-2
Do	...do	10.10.1.23	...do	...do	192	173	45	49	26	19.5	19.5	2-2
Do	Lamra, Tarang.	10.10.1.28	...do	...do	196	170	43	48.5	25	19.5	19.5	2-2
Do	...do	10.10.1.27	...do	...do	185	156	45	48	25	20	19	2-2
Do	...do	10.10.1.25	Male	...do	201	171	45	48	....	19	19	....
Do	...do	10.10.1.26	Female.	Slightly	186	160	43	47	25	19	18.5	2-2
Do	Chong, Tarang.	SM.[2] 36/10	Male	Moderately	191	167	45	48	25	19.5	18	....
Do	...do	SM.34/10	Female.	Slightly [4]	176	173	43	48	24.5	19.5	18.5	2-2
T. lacernata longicanda.	E. Perhentian Island.	S.M.2303/10.	Male	Moderately	171	189	45	47.5	25.5	18	19	....
Do	...do	S.M.2315/10.	Female.	...do	190	184	46	48.5	26.5	20	18.5	2-2
T. lacernata obscura.	Gt. Redang Island.	S.M.2287/10.	...do	...do	174	179	42	44	24	18.5	17.5	2-2
Do	...do	S.M.2282/10.	Male	...do	167	163	40	43	25	19	18.5	....

[1] Preserved in alcoholic. [2] Selangor Museum. [3] pm^3 not in place. [4] Permanent i_1 and c not in place.

TUPAIA LACERNATA LACERNATA Thomas and Wroughton.

1909. *Tupaia lacernata* Thomas and Wroughton, Ann. Mag. Nat. Hist., ser. 8, vol. 4, p. 535, December, 1909.

Type-locality.—Island of Lankavi off the west coast of the Malay Peninsula.

Type-specimen.—In British Museum, Reg. No. 9.11.1.30, skin and skull of adult female, Pulo Lankavi (Kubong Bodak Island, an adjacent islet); collected March 18, 1909, by Mr. H. C. Robinson; original number, 2673; in good condition.

Geographic distribution.—Islands of Lankavi and Terutau, including adjacent islets, west coast of Malay Peninsula. See No. 23 on map on page 75.

Diagnosis.—Differs from *Tupaia lacernata wilkinsoni* of the opposite mainland in its slightly smaller size and less tawny rump, darker tail, and less conspicuous shoulder stripe, and slightly smaller skull and teeth.

Color.—As described above under the species, the tawny element of the rump less pronounced than in the mainland form, and with the dark elements of the tail when viewed from above more conspicuous and contrasted with the color of the back.

Skull and teeth.—These are nearly identical in appearance with those of the mainland animal, but on the whole appear slightly smaller. (Plate 8, fig. 5.)

Measurements.—Type: Head and body, 180 mm.; tail, 155; hind foot, 44; condylo-basal length, 47.5; zygomatic width, 25; width of brain case, 20; maxillary tooth row, 19. Usual measurements: Head and body, 170–185; tail, 140–150; hind foot, 42–44; condylobasal, 45–47, zygomatic width, 24–25; width of brain case, 19; maxillary tooth row, 18. For details of measurements see table, page 57.

Specimens examined.—Seventeen from Pulo Terutau and 14 from Pulo Lankavi.

TUPAIA LACERNATA RAVIANA Lyon.

1911. *Tupaia raviana* Lyon, Proc. Biol. Soc. Wash., vol. 24, p. 167, June 16, 1911.

Type-locality.—Pulo Rawi, Butang Islands, off west coast of Malay Peninsula.

Type-specimen.—In United States National Museum, Cat. No. 104355, Pulo Rawi, December 18, 1899; collected by Dr. W. L. Abbott; original number, 172; in good condition.

Geographic distribution.—Butang Islands, west coast of Malay Peninsula. See No. 24 on map on page 75.

Diagnosis.—Similar to *Tupaia lacernata lacernata* and *T. lacernata wilkinsoni*, but skull generally wider, and rostrum especially thicker and wider, but somewhat lighter in color, and not so tawny on the rump.

Color.—*Tupaia lacernata raviana* differs in color from *T. l. lacernata* in having the light annulations of the hairs less ochraceous and more buffy, and with only a trace of tawny on the rump; the black element of tail is less in evidence, so that the tail as a whole is somewhat lighter; the feet are grayer and less ochraceous than they are in *T. l. lacernata;* the underparts and shoulder stripe are not different in the two forms.

Skull and teeth.—In general, the skull and teeth of *Tupaia lacernata raviana* resemble those of *T. l. wilkinsoni* and *T. l. lacernata*, but the skull is noticeably wider, with a thicker and wider rostrum, and more spreading zygomata. The skull differences while not appearing considerable in a description, are quite marked when skulls of the two

forms are viewed together, and are greater than the differences seen in the skins. (Plate 8, fig. 4.)

Measurements.—Type: Head and body, 184 mm.; tail, 165; hind foot, 46; condylo-basal length, 46.5; zygomatic width, 25.5; width of brain case, 19; maxillary tooth row, 17.5; width of rostrum back of incisors, 7. For measurements of a second specimen from Pulo Adang, Butang Islands, see table, page 57.

Specimens examined.—Two from the Butang Islands, the type from Pulo Rawi, and one from Pulo Adang.

TUPAIA LACERNATA OBSCURA Kloss.

1911. *Tupaia obscura* Kloss, Ann. Mag. Nat. Hist., ser. 8, vol. 7, p. 116, January, 1911.

Type-locality.—Great Redang Island, off east coast of Malay Peninsula, near Tringanu.

Type-specimen.—In Selangor Museum, No. 2279/10. Skin and skull, adult male, Great Redang Island, September 2, 1910; collected by Mr. C. Boden Kloss, original number, 3708. I have not seen the type-specimen.

Geographic distribution.—Great Redang Island. See No. 39 on map on page 75.

Diagnosis.—Differs from the mainland *Tupaia lacernata wilkinsoni* in possessing a generally distinctly lighter coloration and smaller size.

Color.—Based on two topotypes kindly loaned by the Selangor Museum, Reg. Nos. 2282/10, and 2287/10. Neither of the two specimens are in uniformly the same pelage, both having a newer and darker pelage anteriorly, and an older and lighter posteriorly. General color of the upper part of head, neck, and body and outer side of legs a fine grizzle of blackish and tawny ochraceous (darker pelage areas) and of blackish and ochraceous (lighter pelage areas), the ochraceous or tawny ochraceous always in excess; tail, above, a uniform grizzle of blackish and cream buff, the darker color slightly in excess; tail, below, similar but the lighter color predominating, particularly in the middle line; under parts cream color to almost buff yellow; shoulder stripe well defined, whitish or cream color.

Skull and teeth.—The skull and teeth of *Tupaia lacernata obscura* differ from those of the related forms only in their generally smaller size and somewhat relatively larger bullæ.

Measurements.—"Collector's external measurements of type: Head and body, 173; tail, 167; hind foot, 40; ear, 15. Cranial measurements: Greatest length, 48; * * * basal length, 42; * * * greatest cranial breadth, 19.1; zygomatic breath, 25.8." For measurements of two topotypes, see table page 53, and see also Kloss., Jour. Fed. Malay States Museum, vol. 4, p. 192, October, 1911.

Specimen examined.—Two loaned by the Selangor Museum.

TUPAIA LACERNATA LONGICAUDA Kloss.

1911. *Tupaia ferruginea longicauda*, Kloss, Ann. Mag. Nat. Hist., ser. 8, vol. 7, p. 117, January, 1911.

1911. *Tupaia longicauda*, Kloss, Journ. Fed. Malay States Mus., vol. 4, p. 190, October, 1911.

Type-locality.—East Perhentian Island, off Tringanu, east coast of Malay Peninsula.

Type-specimen.—In Selangor Museum No. 2295/10, skin and skull adult female, East Perhentian Island, September 8, 1910. Collected by C. Boden Kloss; original number, 3517. I have not seen the type-specimen.

Geographic distribution.—East and West Perhentian Islands off east coast of Malay Peninsula. See No. 38 on map on page 75.

Diagnosis.—Differs from the other subspecies in its longer tail and lighter color.

Color.—Based on two specimens loaned by the Selangor Museum, Nos. 2303/10 and 2315/10. The general color of *Tupaia lacernata longicauda* is essentially the same as it is in the mainland *T. lacernata wilkinsoni*, but the ochraceous and tawny ochraceous bands on the hairs are wider and more conspicuous, and the lighter color is slightly in excess of the black; the grizzling is coarser, and there is less concentration of the tawny color on the rump, and the anterior parts have no indication of the slight olivaceous tint seen in *T. lacernata wilkinsoni;* essentially the same colors are found in the tails of *T. lacernata longicauda* and *wilkinsoni*, but the black is not in excess in *T. lacernata longicauda;* the under parts of the two forms are essentially alike; the hands and feet of *T. l. longicauda* are more ochraceous than they are in *T. l. wilkinsoni.*

Skull and teeth.—No appreciable differences exist between the skull and teeth of *Tupaia lacernata longicauda* and *T. lacernata wilkinsoni.*

Measurements.—"Collector's external measurements of the type: Head and body, 178; tail, 192; hind foot, 44; ear, 16. Cranial measurements: Greatest length, 51.7; basal length, 44.7; * * * greatest cranial breadth, 19.5; zygomatic breadth, 26.2." For measurements of two topotypes see table, page 53, and for measurements of additional specimens see Kloss, Journ. Fed. Malay States Mus., vol. 4, p. 193, October, 1911. The average external measurements of 24 adults given by Mr. Kloss is: Head and body, 177. 5; tail, 185.6; and hind foot, 43.5. A few specimens have the tail actually shorter than the head and body, 2304/10, 179, 176; 2315/10, 190, 184, and in one case equal 2214/10, 178, 178.

Specimens examined.—Two loaned by the Selangor Museum.

Remarks.—The two treeshrews just described are closely related to one another as well as to the mainland form from the middle of the Malay Peninsula from which they have evidently been derived. Although somewhat more like *Tupaia belangeri* in point of coloration than the other subspecies, yet the mammæ are 2–2=4. Typical

Tupaia glis ferruginea is found on the nearby mainland of Tringanu. *T. l. obscura* and *longicauda* are quite different from the tupaias found on Tioman, Pemangil, and Aor, which are distinctly of the *ferruginea* type.

Mr. Kloss [1] makes the following interesting observations on the habits of this treeshrew: "Of the numerous species of *Tupaia* which I collected personally, *T. longicauda* with *T. nicobarica*, Zelebor and its subspecies *T.* (*N.*) *surda*, Miller, alone are truly arboreal in habit. As a rule the so-called 'treeshrews' are seen and trapped on the ground where they live and feed, or, at most, climb occasionally into low bushes. In them the tail is shorter than the head and body length. The above-named animals, which are met with in high trees and have the habits of squirrels, all possess a tail that is considerably longer than the length of head and body."

Measurements of Tupaia lacernata lacernata and T. lacernata raviana.

Name.	Locality.	Number.	Sex.	Molar teeth worn.	Head and body.	Tail.	Hind foot.	Condylo-basal length.	Zygomatic width.	Width of brain case.	Maxillary toothrow.	Number of mammæ.
					mm	*mm*	*mm*	*mm*	*mm*	*mm*	*mm*	
T. lacernata lacernata.	Pulo Terutau	123981	Male	Moderately	170	150	41	45	24.5	19	18	....
Do	do	123984	do	Much	180	145	43	46	25.5	19	18.5	....
Do	do	123985	do	do	180	145	43	46	25	19	18.5	....
Do	do	123986	do	None [2]	170	145	41	....	....	....	18	....
Do	do	123982	Female	Much	180	143	43	47	24	18.5	18	2-2
Do	do	123983	do	Slightly [2]	170	140	42	43	22.5	19	17.5	....
Do	do	123987	do	Moderately	185	150	42	46.5	23.5	18	18	2-2
Do	do	123988 [3]	do	do	....	....	....	45	....	18.5	17.5	....
Do	do	123989 [4]	do	(5)	195±	145	43	....	....	....	....	2-2
Do	South Udang, Terutau.	9.11.1.17.	Male		180	140	43	....	....	....	....	....
Do	do	9.11.1.20.	Female	Moderately	160	155	42	45.5	24.5	18	17.5	2-2
Do	do	9.11.1.19.	do	Much	170	140	42	46	25	18.5	19	2-2
Do	do	9.11.1.16.	Male	Moderately	170	145	41	45	25	19	18	....
Do	do	9.11.1.15.	do	do	180	150	43	46	25	19	18	....
Do	do	8.2.25.10.	Female	None	158	151	42	47.5	24	19	18	2-2
Do	Terutau	9.11.1.14.	Male	Much	175	135	42	....	....	....	18	....
Do	do	9.11.1.18.	Female	do	185	144	42	45	24	19	18	2-2
Do	Pulo Lankawi	104353	Male	Slightly	171	152	42	46	25	20	18	....
Do	do	123901	do	Moderately	180	145	44	47	25	19	18.5	....
Do	do	104352	Female	None [6]	165	140	41	44	23	18.5	17	....
Do	do	123900	do	do [7]	175	155	42	46	24	19	18.5	....
Do	do	9.11.1.27.	do	Moderately	157	133	42	46.5	24	18.5	18.5	2-2
Do	do	9.11.1.28.	do	Much	165	134	43	46	25	18	18	2-2
Do	do	9.11.1.26.	do	Moderately	160	133	41	47	24.5	19	18.5	2-2
Do	do	9.11.1.25.	do	Slightly	190	140	41	46.5	24	19.5	18	2-2
Do	do	9.11.1.29.	do	Moderately	172	154	44	47.5	....	18.5	19	2-2
Do	do	9.11.1.21.	Male	Much	180	140	41	43.5	23	18.5	18	....
Do	do	9.11.1.22.	do	Moderately	172	152	43	47.5	25	18.5	18	....
Do	do	9.11.1.23.	do	do	185	129	44	47.5	26	19	19	....
Do	Pulo Lankawi, Kubong Bodak Island.	9.11.1.30 [8]	Female	do	180	155	44	47.5	25	20	19	2-2
Do	Pulo Lankawi, South Kilin Island.	9.11.1.24.	Male	Much	160	150	43	....	25	....	18	....
T. lacernata raviana.	Butang Islands, Pulo Rawi.	104355 [8]	do	do	184	165	46	46	26	18.5	18	....
Do	Butang Islands, Pulo Adang.	104354	do	Moderately	178	171	45	46±	25	18.5	18.5	....

[1] Journ. Fed. Malay States Mus., vol. 4, p. 191.
[2] dpm^3, dpm^4 still in place.
[3] Skull only.
[4] Preserved in alcohol.
[5] Adult.
[6] dpm^4 nearly displaced, c^1 just appearing but dc still in place.
[7] pm^4 just appearing, dpm^3 still in place.
[8] Type.

TUPAIA DEMISSA Thomas.

1888. *Tupaja ferruginea* var. *chrysura* JENTINK (not of Günther), Notes Leyden Museum, vol. 11, p. 29, 1889. Type-locality, Deli, Sumatra.

1904. *Tupaia ferruginea demissa* THOMAS, Zool. Anz., vol. 27, p. 723, July 12, 1904.

1905. *Tupaia ferruginea demissa*, SCHNEIDER, Zool. Jahrb., vol. 20, p. 86, 1905.

Type-locality.—Tanjong Bringin, lower Langkat, northeastern Sumatra.

Type-specimen.—In British Museum, Reg. No. 4.6.9.1, skin and skull of adult female, collected at Tanjong Bringin, lower Langkat, Sumatra, February 8, 1898, by Gustav Schneider. Originally preserved in alcohol, but made into a skin probably about 1904. The colors do not appear to have been affected by the alcohol. Type specimen in good condition.

Geographic distribution.—Deli-Langkat region, northeastern Sumatra. It was not found by Dr. W. L. Abbott immediately north of lower Langkat, in the vicinity of Aru Bay, nor in the region of the Siak River a short distance to the southeast. See No. 7, on map on page 75.

Diagnosis.—In all respects like *T. glis ferruginea* except that the color of the tail is cream buff; mammæ, 2–2=4.

Color.—The color of *Tupaia demissa*, with the exception of the tail, is so like that of *T. g. ferruginea* that no detailed description is necessary. The tail, except its base, which is like adjacent parts of body, is cream buff in color throughout its whole extent on both surfaces, although a few brownish hairs may mar the clearness of the upper view.

Skull and teeth.—As in *Tupaia glis ferruginea.*

Measurements.—Type: Hind foot, 44 mm.; condylo-basal length, 49.5; zygomatic width, 27; width of brain case, 20.5; maxillary toothrow, 19. For individual measurements, see table, page 59.

Remarks.—*Tupaia demissa* is a very distinct member of the "*ferruginea*" group. Although described as a subspecies, and occurring on the same land mass with *T. g. ferruginea*, I have here called it a full species because so far as I am aware there is no evidence of it intergrading with the usual form. It appears to be a well-established color anomaly of *T. g. ferruginea* quite parallel with the case of *Tana chrysura* of Borneo. Because the tail has a uniform color and is not a decided mixture of blackish and some buffy or rufescent color, *Tupaia demissa* might with a certain degree of propriety be classed with the *splendidula* group, but I am much more inclined to consider it a perpetuated case of partial albinism in the *ferruginea* group.

Specimens examined.—Six, all from Deli or Langkat. In addition to these I have seen a specimen of this species on exhibition in the Natural History Museum at Strassburg, collected in "Sumatra" in 1903. A specimen of this species is recorded by Jentink in the Ley-

den Museum as *Tupaia ferruginea chrysura* in 1888, collected at Deli by Doctor Hagen. Doctor Jentink considered it a mere color freak, and tentatively applied the name *chrysura* in analogy with *Tupaia tana* var. *chrysura* Günther of Borneo.

Measurements of Tupaia demissa.

Locality.	Number.	Sex.	Molar teeth worn.	Head and body.	Tail.	Hind foot.	Condylo-basal length.	Zygomatic width.	Width of brain case.	Maxillary tooth row.	Number of mammæ.
				mm.	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	
Sumatra, upper Langkat.	4.4.1.4	Male	Moderately	.....	.....	43	50.5	25	20	20	....
Sumatra, lower Langkat.	4.6.9.1[1]	Female	do	.....	.....	44	49.5	27	20.5	19	2–2
Sumatra, Deli	174608	do	Slightly[2]	200±	140±	43	45	23.5	19.5	17	2–2
Do	174609	do	do	200±	155±	45	48.5	25.5	20	19.5	....
Sumatra, lower Langkat.	11461 Berlin[3]	.....	Moderately	.....	.....	.....	49	26.5	20	19.5	....
Sumatra, Langkat	Berlin, Rolle collection, 64.[4]	Female	Adult	.....	.....	.....	.....	.....	.....	.....	2–2

[1] Type. [2] Permanent i[1] half way up. [3] Skull only. [4] Skin only.

TUPAIA BELANGERI (Wagner).

1835. *Tupaia du Pegou* Isadore Geoffroy, in Belanger, Zool, Voyage aux Indes Orientales, pp. 103–107, pl. 4.

1841. *Cl[adobates] belangeri* Wagner, Schreber's Säugthiere, Supplementband, vol. 2, p. 42.

1842. *Tupaia peguanus* Lesson, Nouv. Tabl. Reg. Anim. Mamm., p. 93. Based on precisely the same animal as *Cl. belangeri* of one year earlier.

1879. *Tupaia belangeri*, Anderson Zool. Res. West. Yunnan, p. 126, pl. 7, figs. 6 and 7.

Type-locality.—Siriam, near Rangoon, Pegu, Burma, southeastern Asia.

Type-specimen.—A specimen that might be considered the type is in the Paris Museum of Natural History. It bears the numbers 2 and 1023; it is labeled "Indes orientales," and was probably collected by Belanger, December, 1828. It is an old mounted and much bleached specimen with the skull inside. Aside from historical association, this specimen has little value.

Geographic distribution.—Along the west coast of the Malay Peninsula, from Victoria Point (lat. 10° N.), northward and westward into Pegu and Arakan,[1] and probably extending northward along the river valleys, and on the following islands: Preparis between the Andamans and Pegu; and Bentink, Domel, Kissering, Sullivan,

[1] See Cat. Mamm. Indian Mus., pl. 1, pp. 154–155, 1881.

Clara, James, St. Luke, and St. Matthew of the Mergui Archipelago, and probably other islands of the same group. See No. 2 on map on page 75.

Diagnosis.—Differs from *T. glis ferruginea* in generally lighter and more grayish coloration and from *T. chinensis* in having a distinct ochraceous wash over the rump and lower back; mammæ, 3–3 = 6.

Color.—Upper parts of head, neck, anterior half of back and outer side of forelegs a fine distinct grizzle of cream buff and blackish, the buffy color slightly in excess; lower back, rump, base of tail, outer side of hind legs a fine grizzle of ochraceous and blackish, the ochraceous in excess; lower back distinctly different in color from upper back, but the one imperceptibly merging into the other; tail above usually intermediate in color between anterior and posterior back, but the grizzling less distinct and with an excess of the darker color; underside of tail similar to upper, but lighter and more buffy, and the grizzling less distinct; underparts, including inner sides of legs, cream color to buff yellow.

Skull and teeth.—The skull and teeth of *Tupaia belangeri* show no peculiarities to distinguish them with certainty from those of related species; the rostrum is relatively shorter than it is in *T. glis ferruginea*, and the skull as a whole slightly smaller than it is in *T. glis ferruginea*, and slightly larger than in *T. chinensis*. (Plate 8, fig. 2.)

Measurements.—Usual measurements of adults: Head and body, 175 to 190 mm.; tail, 150 to 160; hind foot, 42 to 45; condylo-basal length, 46 to 48; zygomatic width, 24 to 25; width of braincase, 18 to 19; maxillary tooth row, 18 to 19. For details of measurements, see table, pages 62 and 63.

Specimens examined.—Tenasserim and Pegu, 30, Mergui Archipelago, 26, from the following islands: Bentink, 2; Domel, 4; Kissering, 3; Sullivan, 2; Clara, 1; James, 8; St. Luke, 1; St. Matthew, 5.

Remarks.—*Tupaia belangeri* as represented by specimens from the Mergui Archipelago and the mainland opposite is a well marked form. From the type-locality, however, specimens are less differentiated. In the British Museum are two skins from Rangoon, one of which, Reg. No. 6.4.5.3, is quite typical of the species as here described; the other, Reg. No. 7.7.20.7, is scarcely ochraceous posteriorly and bears considerable resemblance to *T. chinensis*. Both these skins were collected in February of different years, and both are adult. It would appear that *T. belangeri* is not as differentiated at the type-locality as it is further southward along the coast. As originally described *Tupaia belangeri* does not appear to be different from *T. chinensis*. In the old accounts mention is not made of the distinct ochraceous wash over lower back, but as the species at that time was being separated from *T. ferruginea*, this is not surprising. The old specimen,

that may be taken as the type of the species, has been exposed to the light too long to be of value in determining whether it was a typical *T. belangeri* or approached *T. chinensis*. The facts appear to be that *belangeri* is the oldest name for the continental Tupaias that are not *ferruginea*. From the description and supposed type-specimen, the name *belangeri* might be applied to what I call in this paper *belangeri* or *chinensis*, but at the type-locality of *belangeri* occur treeshrews certainly belonging to what is here called *belangeri;* and *chinensis* has been proposed by Anderson for uniformly grizzled grayish treeshrews farther northward, thus leaving *belangeri* perfectly available for the Tenasserim animal.

The relationship between *Tupaia belangeri* and *T. chinensis* seems intimate, and it would not be surprising if the two forms were found to intergrade, *belangeri* being confined to the coastal region and *chinensis* to the higher region of the interior. As it is, many of the specimens examined are not typical of *belangeri*, among them British Museum, Reg. No. 7.7.20.7 Rangoon; Reg. No. 85.8.1.82 Meetan; Reg. Nos. 82.11.18.1, 85.8.1.86 Thaungyeen Valley, and Reg. No. 85.8.1.90 Bankasun, and the two Kokareet specimens in Genoa. Before determining this point it would be desirable to obtain good series of skins from the mouths of the Irawadi and Salwen Rivers and at various points from along the river until the upper courses in or near Yunnan are reached.

The specimens in the United States National Museum from the various islands of the Mergui Archipelago are fairly uniform in most of their characters. A few differences in size or color are indicated in some of them, but it does not appear possible to divide them into geographic races, or to separate the island forms as a whole from those of the adjacent mainland. On the mainland, Bentink, St. Luke, St. Matthew, the skins appear brighter on the lower back, and on Domel, Sullivan, Clara, James, and Kissering, the skins are slightly duller on the lower back, and perhaps darker anteriorly. A few slight differences in size are revealed by examining the table of measurements. All the St. Matthew specimens have a maxillary toothrow of 19 mm. or over, while on James Island it is 18.5 or under, and in a single specimen from St. Luke Island it is only 17.5. But these extremes are all bridged over by intermediate specimens from other islands or from the mainland.

A treeshrew probably related to *Tupaia belangeri* occurs on Preparis Island, between the Andamans and Pegu. A specimen from there is recorded by Anderson in the Catalogue of Mammals of the Indian Museum, Calcutta, part 1, page 155, listed as "hh." It is said to be darker than the mainland specimens, and undoubtedly represents an undescribed form.

Measurements of Tupaia belangeri.

Locality.	Number.	Sex.	Molar teeth worn.	Head and body.	Tail.	Hind foot.	Condylo-basal length.	Zygomatic width.	Width of brain case.	Maxillary tooth row.	Number of mammæ.
				mm.	*mm.*	*mm*	*mm*	*mm*	*mm*	*mm*	
"Pegu or Upper Burma" from Blanford.	63.5.9.11	.....	Moderately	.....	.....	42	46	26	19	18	....
Rangoon, Burma	7.7.20.7 [1]	Female	do	.....	.....	45	47	25	20	18.5	3-3
Do	6.4.5.3	Male	Slightly	180	180	43	47	22	19	18	....
South of Moulmein	85.8.1.80	do	Moderately	.....	.....	42	....	25	18	17.5	....
45 miles east of Moulmein	85.8.1.83	do	do	.....	.....	44	....	25	19	18	....
Tichera, Amherst district, Burma.	6.7.5.2	Female	do	159	151	41	....	24	18	17.5	....
Tavoy, Tenasserim	85.8.1.84	.....	Slightly	.....	.....	41	....	24	19.5	18	....
Matan, B. Burma	85.8.1.82 [1]	.....	do	.....	.....	42	....	24.5	19	18	....
Mutan, Tenasserim	85.8.1.81	Male	do	.....	.....	44	....	....	19.5	18.5	....
Tenasserim, from Davidson.	85.8.1.78	do	Moderately	.....	.....	43	....	24.5	19	18	....
Do	85.8.1.79	.....	Much	.....	.....	43	....	27	20	17.5	....
Tenasserim, Thaton	85.8.1.85	Male	Moderately	.....	.....	45	....	....	19	18	....
Tenasserim, Thaungyeen Valley.	82.11.18.1 [1]	do	Slightly [2]	.....	.....	45	....	....	18.5	17	....
Tenasserim, Thaungyeen River.	85.8.1.86 [1]	Female	None	6.6	7	42	....	....	19	16	....
Tenasserim, Bankasun	85.8.1.90 [1]	.....	.....	.....	.....	44	....	....	....	....	....
B. Burma, road to Myanadee.	8.3.9.1	.....	.....	.....	.....	44	....	....	....	....	....
Cheonkhon	85.8.1.87	.....	Slightly	7.5	80	44	....	24.5	19	18	....
Kokaret, [5] Tenasserim	Genoa, Fea [3]	Female	Much	190±	145±	45±	46	25	18.5	18	....
Tenasserim	88.6.18.14 [4]	Male	Moderately	180	185	43	44	26	19.5	17	....
Do	88.6.18.24 [4]	Female	Adult	185	175	43	....	....	....	....	3-3
Kokareet, [5] Tenasserim	88.12.1.32 [4]	Male	do	180	170	44	....	....	....	....	....
Do	88.12.1.33 [4]	Female	Adult	185	170	44	....	....	....	....	3-3
Kaukargit, Burma	5509, Berlin	.....	Slightly	190±	155±	45	....	23	19.5	17	....
Do	5508, Berlin	.....	Moderately	200±	165±	45	47	....	19.5	18	....
Thagata, [5] Burma	Genoa, Fea collection. [4]	Female	.....	185	190	45	....	....	....	....	3-3
Mount Mooleyit, [5] Burma	do. [4]	Male	(6)	190	180	45	....	....	....	....	....
Do	do. [4]	Female	.....	180	175	45	....	....	....	....	2-2
Do	do. [4]	Male	(7)	140	135	41	....	....	....	....	....
Kokareet [5]	do	do	(6)	190	180	46	....	....	....	....	....
Do	do	Female	.....	180	175	46	....	....	....	....	....
Moulmein	Genoa [8]	Male	.....	185	175	46	....	....	....	....	....
Pegu	1023, Paris [9]	.....	(10)	.....	.....	42	....	....	....	....	....
Tavoy, Tenasserim	2143, A. M. N. H. [11]	Female	.....	.....	.....	42	....	....	....	....	3-3
Tenasserim, Telok Besar [12]	124284	Male	Moderately	190	163	43	48.5	25	18.5	18.5	....
Do	124283	Female	do	190	160	43	48	24.5	18.5	19	3-3
Tenasserim, Bok Pyin	104358	Male	do	171	152	43	46	25	19	18	....
Tenasserim, Sungei Balik [12]	111996	do	Slightly	175	165	44	46.5	23.5	19.5	18.5	....
Tenasserim, Tanjong Badak [12]	104357	do	Moderately	178	152	44	47	24.5	19.5	18.5	....
Tenasserim, Victoria Point	124003	do	do	197	168	44	48	24.5	18.5	18.5	....
Tenasserim, Telok Besar [12]	124282 [4]	Female	(13)	190±	155	42	....	....	....	....	3-3
Mergui Archipelago, Bentinck.	104364	do	Moderately	178	159	42	47	24.5	19	18.5	3-3
Do	104365	do	None [14]	152	140	41	39	20	18	....	....
Mergui Archipelago, Clara	124143	do	Much	190	175	44	48±	26.5	19.5	19	3-3
Mergui Archipelago, James.	124076	Male	Moderately	190	155	41	47	25	19	18	....
Do	124078	do	do	180	152	42	46.5	23.5	19	18	....
Do	124079	do	do	175	135	41	45	24	19	18	....
Do	124077	Female	do	185	145	41	47	24.5	19	18.5	3-3
Do	124080	do	do	185	150	42	47	24.5	18.5	18.5	3-3
Do	124081	do	Slightly	168	150	43	46	23	18.5	18	....
Do	124082 [4]	do	(13)	185±	150	42	....	....	....	....	3-3
Do	124083 [4]	do	(13)	195±	155	42	....	....	....	....	....

[1] Not typical, resembling *T. chinensis*.
[2] *c.* and *pm*[1] not in place.
[3] Mounted.
[4] Preserved in alcohol.
[5] East of Moulmein.
[6] Adult, genitalia well developed.
[7] About one-third grown.
[8] Received from Calcutta Museum.
[9] Type.
[10] Skull inside.
[11] American Museum of Natural History, New York.
[12] Just north of Victoria Point.
[13] Adult.
[14] *m* [1] not quite in place.

Measurements of Tupaia belangeri—Continued.

Locality.	Number.	Sex.	Molar teeth worn.	Head and body.	Tail.	Hind foot.	Condylo-basal length.	Zygomatic width.	Width of brain case.	Maxillary tooth row.	Number of mammæ.
				mm.	*mm.*	*mm*	*mm*	*mm*	*mm*	*mm*	
Mergui Archipelago, Kisseraing.	124203	Male	Moderately	180	150	43	46	25.5	19	17	....
Do	124202	Female	do	190	150	41	46	25	19	18	3–3
Do	124204	do	do	180	160	43	47.5	25	19	18	3–3
Mergui Archipelago, Sullivan.	124102	Male	do	183	152	43	47.5	24.5	19	17.5	....
Do	124103	Female	do	185	160	43	47.5	24.5	19.5	18.5	3–3
Mergui Archipelago, St. Matthew.	104359	Male	do	184	159	43	49	26.5	19.5	19	....
Do	104361	do	do	171	152	45	48.5	26.5	19	19	....
Do	111911	do	Much	180	150	43	47.5	25.5	18.5	19.5	....
Do	104360	Female	Moderately	184	152	43	48.5	25.5	18.5	19	3–3
Do	104400, skull.	do	Slightly	165	152	....	47.5	25.5	19	19.5	....
Mergui Archipelago, Domel.	124173	Male	Moderately	180	138	45	48	25	19±	19.5	....
Do	124174	do	do	175	135	43	47±	26.5	19.5	18.5	....
Do	104363	Female	Much	165	152	41	45.5	24	18.5	19	3–3
Do	124175	do	Moderately	175	155	42	46.5	24	18.5	18	3–3
Mergui Archipelago, St. Luke.	104362	Male	Slightly	178	152	42	47	24	19	17.5	....

TUPAIA CHINENSIS Anderson.

1879. *Tupaia chinensis* Anderson, Zool. Res. West. Yunnan, p. 129, pl. 7, figs. 8 and 9.

Type-locality.—Ponsee, Kakhyen Hills, 3,185 feet, and Muangla, Sanda Valley, 2,400 feet, western Yunnan, China.

Type-specimens.—Two specimens of this species were evidently secured by Dr. Anderson, No. 204*a*, adolescent male in alcohol, and its skull, Ponsee, and No. 204*b* and *c*, skin of an adult and its skull, Muangla, in the Catalogue of Mammalia in the Indian Museum, Calcutta, Part I, 1881, page 155. So far as I am aware these specimens are still in Calcutta. They are not in London at the British Museum, and I have not seen them. Cranial measurements of both are given in the original account, external measurements of one of them, and illustrations of the skull, probably of the specimen of which the external measurements are given (determined by comparing some of the figures given with the actual measurements of the illustration). The specimen whose skull is illustrated and whose external measurements are given should be considered the type. As to whether it is the Ponsee or the Muangla specimen it is impossible to say, though if both specimens are still intact a careful examination of them and the measurements and illustrations would probably disclose which specimen is the type and which of the two localities is the exact type-locality.

Geographic distribution.—*Tupaia chinensis*, as here understood, ranges from northern Tenasserim and Burma northward into China as far as Mitschi (or Meechee) (?) and from Nepal, on the west, as far east as Mongtsze and Tonkin, China. See No. 1 on map on page 75.

Diagnosis.—*Tupaia chinensis* is characterized by a unifrom grizzled olivaceous gray color without ferruginous on upper parts, or ochraceous colors on rump; skull slightly smaller than in *T. glis ferruginea*, with relatively shorter rostrum; mammæ, 3–3=6.

Color.—Upper parts of head, neck, and body and outer side of legs a fine uniform grizzle of blackish and a color that varies from buff to ochraceous in certain individuals, the lighter colors predominating anteriorly; both colors are about equally mixed, in some individuals the lighter colors are in excess, and in others, especially in the middle line posteriorly the black admixture is sometimes in excess; the tail above is a coarse grizzle, sometimes showing indistinct annulations of the same colors as have the upper parts of body, below the tail is lighter, especially in the middle line; the underparts of head, neck, and body, including the inner sides of the legs, vary from distinct whitish, sometimes with the dark bases of the hairs showing through, to buffy; hands and feet similar to outer sides of legs but often lighter and grayer; shoulder stripe poorly developed and sometimes practically obsolete. Three skins from Meechee, China, are quite light and grayish, but are almost exactly matched by a British Museum skin from Manipur, Reg. No. 85.8.1.89. The Darjiling and two of the Tura skins are rather dark, as are also the Siamese skins, none, however, are so generally dark as are *Tupaia concolor* and *T. modesta*.

Skull and teeth.—These are of the same general style as they are in *T. glis ferruginea*, but average slightly smaller and have a relatively shorter rostrum, so that the distance from the end of the premaxillary to the lachrymal notch is generally distinctly less than the distance from the notch to the external auditory meatus. Although *T. chinensis* was originally separated from *T. belangeri* mainly on skull characters, I have been able to find no satisfactory constant characters to distinguish skulls of the two forms. The individual variation in skulls of *Tupaia* is quite considerable, and with a relatively small number of specimens such as Anderson seems to have had it would be comparatively easy to find distinguishing features. I regret that I have not seen his type or cotypes. (Plate 8, fig. 1.)

Measurements.—Anderson's measurements of the cotypes converted to millimeters: Head and body, ——, 165 mm.; tail, ——, 156; hind foot, ——, 40; inferior margin of foramen magnum to tip of premaxillaries, 39, 40 (making a condylobasal length of approximately 42, 43); zygomatic width, 22, 23. The usual measurements of adults corresponds very closely with those of the cotypes, the head and body measurement is often 5 mm. longer, but the tail in most of the specimens which have collectors' measurements is nearly always from 5 to 15 mm. longer than head and body, but the skins and alcoholics of which I have taken approximate head and body, and tail measurements show the tail to be shorter than head and body. The maxillary tooth row is about 17.5. For details of measurements, see table, page 66.

Specimens examined.—Forty-three, mostly in the collections of the British Museum, only one in the United States National Museum. For list of specimens, see table, page 66.

Remarks.—The specimens which I have included under *Tupaia chinensis* constitute a somewhat heterogeneous collection. With the *T. glis ferruginea* group I have recognized many slightly differentiated geographic forms, mostly insular, but with *Tupaia chinensis* I have been extremely conservative and have not ventured to describe some color variations that are as pronounced as some of the color variations in the *ferruginea* group. This is largely from lack of adequate material and to the fact I have not seen the cotypes or even topotypes of *T. chinensis*. Many of the localities are represented by only single specimens instead of adequate series and are unaccompanied by notes as to altitude. The specimens that one might be inclined to recognize as races of *T. chinensis* are the three Meechee[1] specimens very light in color, though showing degrees of lightness among themselves and the rather full-pelaged olivaceous specimen from Jerkalo on the Thibet boundary. Light as are the Meechee specimens compared with the majority of the others, yet they are not more different from them than two specimens from Tura, Assam (American Museum of Natural History, Cat. Nos. 26843 and 26841), showing there may be considerable individual variation. Until more material is at hand, with carefully worked out localities it seems best for the present to refer all the northern uniformly grizzled grayish continental treeshrews to the single species *Tupaia chinensis*. The relationship of *Tupaia chinensis* to *T. belangeri* is not perfectly clear. What I have called *T. belangeri* is typical in the Mergui Archipelago and adjacent mainland, and is certainly a very different animal from *T. chinensis* as found away from the seacoast, back in the interior. I am free to admit that I have seen certain specimens from Tenasserim, particularly some to the east of Moulmein that could with considerable propriety be placed in either species, and I strongly suspect that future collections, with carefully identified localities and altitudes, will show that *Tupaia chinensis* is a subspecies of *T. belangeri*. If that should prove to be the case, the relation of them to *Tupaia glis ferruginea* will be interesting. At present *T. chinensis* and *T. belangeri* appear to be sharply separated from *T. g. ferruginea* and *T. lacernata wilkinsoni* by the presence of six instead of four mammæ as was pointed out by Thomas[2] in 1891. In spite of that marked

[1] The only Meechee that I have been able to find on modern maps is Mitsehi (see p. 75). The three Meechee specimens were collected by Styan and are labeled Meechee, Yunnan. No Meechee appears on the numerous maps of Yunnan that I have examined. As to the exact locality of the Meechee specimens I can not say. It is very doubtful if treeshrews occur as far north in China as Mitschi. Perhaps Meechee is only a small village in Yunnan and the three specimens may be virtual topotypes.

[2] Ann. Mus. Civ. Stor. Nat. Genova, ser. 2, vol. 10, p. 920, 1890–91.

difference, however, *T. lacernata wilkinsoni* in point of color appears as an almost perfect intermediate between *Tupaia glis ferruginea* and *T. belangeri*. With the certain rather doubtful specimens from Tenasserim it may ultimately develop that but a single species of *Tupaia* occurs on continental Asia ranging from Singapore to Meechee and from Nepal to Tonkin, but wherever there are sufficient climatic or physiographic differences subspecies have been produced, of which five continental forms have been described—*T. glis ferruginea, lacernata wilkinsoni, belangeri, chinensis, concolor.*

Measurements of Tupaia chinensis.

[A. M. N. H.=American Museum of Natural History, New York. B. M.=British Museum.]

Locality.	Number.	Sex.	Molar teeth worn.	Head and body.	Tail.	Hind foot.	Condylo-basal length.	Zygomatic width.	Width of brain case.	Maxillary tooth row.	Number of mammæ
				mm.	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	
Meechee, China	8.8.11.14	Female	None [1]	.....	.....	45	....	....	....	16.5	....
Do	8.8.11.13	...do	.....	.....	.....	41	....	....	....	....	3-3
Do	8.8.14.14	.....	Slightly	.....	.....	42	....	23	19	16.5	....
Jerkalo, China	Paris, 173	.....	No skull	180±	140±	41±	....	....	....	....	....
Nepal, from Hodgson	79.11.21.306	.....	...do	.....	.....	.....	....	....	....	....	....
Sikhim	86.11.15.1	.....	Moderately	.....	.....	43	....	....	....	17.5	....
Darjiling	87.2.9.1	.....	.....	.....	.....	44	....	....	....	....	....
Tura, Assam	A.M.N.H.26841	Female	.....	215±	160±	45	....	....	....	....	2-2
Do	A.M.N.H.26843	...do	Moderately	205±	155±	42	44	24.5	18.5	16.5	3-3
Do	A.M.N.H.26844	Male	.....	200±	190±	43	....	....	....	....	....
Cachar	82.2.6.3	.....	Slightly	.....	.....	44	....	24	19	17.5	....
Amoli, Manipur	85.8.1.88	.....	Moderately	.....	.....	42	....	....	18±	16.5	....
Machi, Manipur	85.8.1.89	.....	...do	.....	.....	41	....	23.5	18	16.5	....
Myitkyina	9.7.20.1	Male	Slightly	.....	.....	40	42	22.5	18.5	16	....
Bhamo	Genoa, Fea [2]	...do	About half grown.	160	160	41	....	....	....	....	....
Zibugaung Lower Chindwin.	6.7.5.1	...do	Slightly	173	.....	40	44±	25.5	18	17.5	....
Carin Hills	20888	...do	Moderately	.....	.....	43	46	25.5	19	17.5	....
Chengmai, Siam	98.10.5.6	Female	Much	168	175	42	45	24	19	17.5	3-3
Do	98.10.5.4	Male	...do	179	195	45	47	27	19.5	18.5	....
Do	98.10.5.3	...do	Moderately	171	181	44	47	26	19	18.5	....
Do	98.10.5.5	...do	Slightly	173	186	42	46	25.5	19	18	....
Mung Pai, Siam	9.10.11.11	Female	Moderately	165	169	41	45	....	19.5	17	....
Do	9.10.11.10	...do	Much	143	174	43	46	25	18.5	17.5	....
Nan, Siam	98.2.8.12	...do	Moderately	170	177	43	47.5	25	19	18	3-3
Do	97.11.2.14	...do	None [3]	170	184	43	46	23.5	20	18	3-3
Do	97.11.2.8	Male	.....	173	185	45	....	....	....	....	....
Do	97.11.2.10	...do	None [4 5]	130	135	40	....	....	....	....	....
Do	97.11.2.11	...do	...do [4 5]	132	142	40	....	....	....	....	....
Do	97.11.2.12	Female	...do [4 5]	122	130	38	....	....	....	....	....
Do	97.11.2.13	...do	...do [4 5]	124	132	39	....	....	....	....	....
Do	97.11.2.9	Male	...do [4]	112	125	38	....	....	....	....	....
Me Ping River, north of Raheng, Siam.	7.11.13.2	...do	...do [6]	159	178	41	43	....	18.5	17	....
Do	7.11.13.3	Female	Slightly	171	184	42	45	24	19	17.5	3-3
"Siam"	78.6.17.15	.....	None	.....	.....	40	40	....	19	....	....
"Camboja" [7]	78.6.17.26	.....	No skull	.....	.....	43	....	....	....	....	....
"Burma" from Blyth	62.7.16.12	.....	Moderately	.....	.....	44	....	25.5	19	17.5	....
Lao Mountains, Siam	B.M.1452 [8]	.....	None [9]	.....	.....	39	37	....	19	....	....
Do	B.M.1452 [8]	.....	...do	.....	.....	40	44	24.5	19	17	....
Pexaburg, Siam	Paris, 1244	Female	Moderately	195±	160±	42±	....	25	19	18	2-2
Mongtsze, China	Brit. Mus	...do	...do	179	160	42	45	24	19	17	3-3
Do	...do	Male	Slightly	185	164	44	44	24	20	16	....
Tonkin, China	Berlin [2]	...do	Very young.	130	110	41	....	....	....	....	....
Do	...do [2]	...do	...do	110	90	35	....	....	....	....	....
Southern China [10]	A 1706, Berlin	.....	Slightly	(11)	....	....	48	20	19.5	19	....

[1] *pm* [4] half through alveolus.
[2] Preserved in alcohol.
[3] *pm* [2] halfway through.
[4] *m* [1] last tooth in place.
[5] Nest of four young ones in hollow bamboo.
[6] *dc* [1] still in place.
[7] Not typical; may be *T. concolor.*
[8] Skeleton, British Museum.
[9] *m* [2] just appearing.
[10] Not typical, rostrum short and heavy, teeth large and heavy.
[11] Skull only; no skin.

TUPAIA DISSIMILIS (Ellis).

1860. *Sciurus dissimilis* ELLIS, in Gray, Ann. Mag. Nat. Hist., ser. 3, vol. 5, p. 71.

Type-locality.—Pulo Condore, off south coast of Siam.

Type-specimen.—No type-specimen ever existed so far as known. This species was thought to be a peculiar squirrel by W. Ellis, a surgeon on Captain Cook's third voyage. The expedition stopped at Pulo Condore, 1780, in the latter part of January. Ellis wrote a description in Latin, published by Gray in 1860, and made an excellent drawing of the entire animal and of its anterior teeth. Through the kindness of the authorities of the British Museum, Natural History, in whose library Ellis's manuscript and drawings are now kept, a photographic reproduction of this picture appears as plate 1.

Geographic distribution.—Pulo Condore. See No. 27 on map on page 75.

Diagnosis.—A geographic form of *Tupaia chinensis* distinguished by its smaller size; hind foot, 38–40; *T. chinensis* usually over 40 mm.; mammæ unknown.

Color.—Based on Cat. No. 3745, Berlin Museum, originally received from the Paris Museum, an old mounted specimen with skull removed. Upper parts of head, neck, and body, a grizzle of ochraceous and blackish, the two colors about equally mixed, tail similar but grizzle coarser; ochraceous color on head slightly lighter than on body; outer side of legs similar to adjacent parts of body, underparts and inner side of legs with much hair gone and soiled, apparently dull buffy; underside of tail in middle line similar to rest of underparts; margins of tail underneath a coarse mixture of buffy and blackish.

Skull and teeth.—Of similar form to those of *Tupaia belangeri* (comparison made with Berlin Burma specimen), but smaller, rostrum narrower, and brain case decidedly narrower; teeth similar to those of *T. belangeri*, but m^1 and m^2 shorter.

Measurements.—Hind foot, 38–40 mm.; condylo-basal length about 45; zygomatic width, 23–24; width of brain case, 18–19; maxillary toothrow 17. In mounted specimens the head and body is 180–200, and the tail 140–165 mm. See table, page 70.

Specimens examined.—Three, two in Paris, and one in Berlin, all probably collected by Germain, in 1882.

Remarks.—There can be little doubt as to the distinctness of *T. dissimilis* from *T. chinensis*, the rather limited material showing it to be distinctly smaller. Probably these are good color characters as well, but at present there is not sufficiently good material of either species to point them out. Although this was the first species of a treeshrew to come under the observation of Europeans, this is the first time it has been given recognition as a species.

TUPAIA CONCOLOR Bonhote.

1907. *Tupaia concolor* BONHOTE, Abstr. Proc. Zool. Soc. London, p. 2, January 22, 1907 (also see Proc. Zool. Soc. London, 1907, p. 7, June, 1907).

Type-locality.—Nhatrang, on the coast of Annam.

Type-specimen.—In British Museum, Reg. No. 6.11.6.3, skin and skull of an adult male, collected by Dr. J. Vassal, at Nhatrang, Annam, March 22, 1906; original number, 59; in good condition.

Geographic distribution.—Southern Annam and northern Cochin China, probably along the coast. See No. 3 on map on page 75.

Diagnosis.—Similar to *Tupaia chinensis* but larger, more bushy tail, and larger, longer skull; mammæ probably 2–2 = 4.

Color.—Type: Upper parts of head, neck, body, outer side of legs, and feet a grizzle of ochraceous buff and blackish, the two colors about equally mixed, but mid-dorsal area slightly darker; anteriorly the light color is more buffy, and posteriorly more ochraceous, but the differences not at all conspicuous; tail above similar to adjacent parts of body, but the grizzle much coarser; tail below with outer half similar to upper surface, central portion dull pale buffy, mixed with blackish, hairs of tail very conspicuously annulated and when artificially spread out, five distinct light bands may be seen, alternating with as many blackish ones; under parts generally dull buffy.

Skull and teeth.—Large and heavy when compared with *Tupaia chinensis*, with a narrowed rostrum, distance from lachrymal pit to premaxilla equal to distance from pit to center of external auditory meatus.

Measurements.—Type: Head and body, 230 mm.; tail, 140; hind foot, 43; condylo-basal length, 50; zygomatic width, 29; width of brain case, 21; maxillary toothrow, 20. For measurements of a paratype and four specimens from Cochin China, see table, page 70.

Remarks.—*Tupaia concolor* is at once distinguished from *T. chinensis* by its much larger size, especially seen in its skull measurements. At the time it was described it was known only from the type-locality. There is one specimen in the Paris Museum, No. 1149, marked "Cochin China," which evidently belongs to this same species. Its external measurements are large, and its skull measurements agree very closely with those of *T. concolor*. While I have not had the opportunity of comparing the two specimens directly, my notes show that the Cochin China skull differed from the usual Siam skulls of *T. chinensis* in nearly the same manner that *T. concolor* does. The Cochin China skull, however, is rather narrower and has less spreading zygomata. Three other specimens marked Cochin China in the Paris Museum represented by skins only, I have assigned to *T. concolor* mainly on geographic grounds. One of them, collected by Germain,

may have come from Pulo Condore, and one of the others has a distinctly small hind foot like that of the Cordore animal. See table, page 70.

Specimens examined.—Six. See table, page 70.

TUPAIA MODESTA Allen.

1906. *Tupaia modesta* ALLEN, Bull. Amer. Mus. Nat. Hist., vol. 22, p. 481, Dec. 17, 1906.

Type-locality.—Island of Hainan, off the south coast of China.

Type-specimen.—In American Museum of Natural History, New York, Cat. No. 26654, collected at Lei-Mui-Mon, Hainan, January 5, 1903, through agents of Mr. Alan Owston; skin well preserved, but skull damaged posteriorly.

Geographic distribution.—Island of Hainan. See No. 4 on map, on page 75.

Diagnosis.—A geographic form of *Tupaia chinensis* distinguished by its generally darker coloration, externally not unlike *T. concolor*, but distinctly smaller; mammæ, 2–2 = 4.

Color.—In general coloration *Tupaia modesta* is essentially like *T. concolor*, but the underparts are more whitish, and when the hairs of the tail are artificially spread only three distinct buffy annulations are seen instead of five.

Skull and teeth.—The skulls of *Tupaia modesta* available for examination are considerably damaged. Apparently they are not essentially different from those of *T. chinensis*.

Measurements.—Type: Hind foot, 46 mm.; zygomatic width, 25.5; width of brain case, 19.5; maxillary tooth row, 18. The type has the largest hind foot in the series, most of the other specimens measuring only 43 mm. See table, page 70.

Remarks.—*Tupaia modesta* is quite distinct in its generally darker color from most specimens of *T. chinensis*, if not appearing distinctly darker with reference to the upperparts, the tail and underparts appear so. As to how different it is from tree shrews on the mainland adjacent to Hainan it is impossible to say. The nearest specimens geographically that I have seen are two from Tonkin in alcohol, young, and so useless for comparison. The two Mongtsze specimens are very dark above, but are distinctly whitish underneath. It is to be observed that *Tupaia concolor* of the southeast coast region of Asia is also a dark-colored animal, but distinctly larger than *T. modesta*.

The number of mammæ, 2–2 = 4, in this species and the preceding is interesting as in all the other continental treeshrews north of the Malay Peninsula, the number is 3–3 = 6. As only one specimen in each species is available for determining the number of mammæ, too much weight can not be attached to this peculiarity.

Specimens examined.—Seven, from various localities in Hainan. See table, page 70.

Measurements of Tupaia concolor, dissimilis, and modesta.

Name.	Locality.	Number.	Sex.	Molar teeth worn.	Head and body.	Tail.	Hind foot.	Condylo-basal length.	Zygomatic width.	Width of brain case.	Maxillary tooth row.	Number of mammæ.
					mm	*mm*	*mm*	*mm*	*mm*	*mm*	*mm*	
T. concolor..	Nhatrang, Annam.	6.11.6.4.....	.....	Slightly....	215±	160±	46	50	28	20	19.5	....
Do.....	.....do.....	6.11.6.3 [1]....	Male...	Moderately.	230±	140±	43	50	29	21	20	....
Do.....	Cochin China....	1149, Paris.....	.....	Slightly....	220±	145±	46±	49±	26.5	19.5	20	....
Do.....	.....do.....	303, Paris..	Female	.....	210±	145±	40±	....	....	....	....	2-2
Do.....	Cochin China, Saigon.	678, Paris...	...do....	.....	210±	150±	44±	....	....	....	....	....
Do.....	Cochin China [2]..	9, Paris [3]...	Male...	.....	180±	160±	40±	....	....	....	....	....
T. dissimilis.	Pulo Condore...	3745, Berlin	Female	Moderately.	200±	165±	40	45±	25±	18	17	....
Do.....	.....do.....	(9) Paris [3]..	.....	None [4].....	190±	160±	39±	....	23	19	17	....
Do.....	.....do.....	1096, Paris.	.....	.....	180±	140±	38±	....	....	....	....	....
T. modesta...	Hainan, Lei Mui Mon.	A. M. N. H. 26654.[1]	Male...	Moderately.	.....	.....	46	....	25.5	19.5	18	....
Do.....	Hainan, Hoihow.	26658 [5 6]....	...do....	.....	.....	.....	43	....	....	....	....	....
Do.....	Hainan, Lei Mui Mon.	26657 [6].....	...do....	Slightly....	.....	.....	45	....	25	19.5	18	....
Do.....	.....do.....	26655 [6].....	...do....	.....do.....	185±	155±	43	....	....	19.5	18	....
Do.....	Hainan.....	26660 [6].....	Female	Moderately.	200±	160±	44	....	....	....	18.5	2-2
Do.....	Hainan, Lei Mui Mon.	26656 [6].....	Male?..	.....do.....	.....	.....	43	....	....	....	18	....
Do.....	Hainan, Utoshi.	26659 [6].....	Female?	Slightly....	.....	.....	43	....	25.5	20±	18	....

[1] Type.
[2] Though labeled "Cochinchina." I strongly suspect it came from Pulo Condore, being collected by Germain, 1882. See No. 9, Paris, *T. dissimilis*.
[3] Germain, 1882.
[4] *dpm* [4] still in place.
[5] The skeleton of this specimen is figured by Gregory, Bull. Amer. Mus. Nat. Hist., vol. 27, p. 276, 1901.
[6] All these specimens are in the American Museum of Natural History, New York.

TUPAIA HYPOCHRYSA Thomas.

1895. *Tupaia ferruginea hypochrysa* THOMAS, Ann. Mus. Civ. Stor. Nat. Genova, ser. 2, vol. 14, p. 6, footnote, January 7, 1895.

Type-locality.—Java.

Type-specimen.—In British Museum, Reg. No. 86.7.2.12, skin and skull of adult male, collected in Java, in 1856, by Henry Blyth. The skin is in good condition, but skull damaged in the occipital region after the manner of bird collectors.

Geographic distribution.—Java. See No. 11 on map on page 75.

Diagnosis.—Above blackish finely grizzled with buffy or ochraceous, tail blackish, underparts ochraceous rufous; mammæ unknown.

Color.—Upper parts of head, neck, body, and outerside of legs a fine uniform grizzle of blackish and dull ochraceous rufous anteriorly gradually passing into pale raw sienna, the blackish color rather in excess; tail, above blackish finely and sparingly lined with cream buff; tail below, a rather coarse mixture of cream color and blackish, the lighter color predominating in the middle line, and the black color predominating on the margins and tip; underparts of head, neck, and body ochraceous rufous, extending to inner side of legs but there considerably admixed with blackish brown, hands and feet blackish brown; shoulder stripe barely indicated, ochraceous rufous.

Skull and teeth.—The skull and teeth of *Tupaia hypochrysa* are not fundamentally different from those of *T. g. ferruginea.* The skull averages larger as a whole, the rostrum is relatively long and heavy, the distance from the lachrymal notch to tip of premaxillary is equal to distance from notch to posterior edge of external auditory meatus; the bullæ are smaller than they are in *T. g. ferruginea;* zygomatic arch wide and heavy and strongly marked anteriorly for insertion of muscles; the teeth are larger and heavier and the tooth-row as a whole distinctly longer. (Plate 9, fig. 6.)

Measurements.—Type and a specimen from Mount Salak, Cat. No. 154599, U.S.N.M. Head and body, ——, 145 mm.; tail, ——, 145; hind foot, 48, 49; condylo-basal length, 51.5, 51; zygomatic width, 26, 28; width of brain case, 19.5, 21.5; maxillary tooth row, 21, 20.5.

Remarks.—While *Tupaia hypochrysa* is probably the Javan representative of *T. glis ferruginea,* yet it is a very distinct species. When first described specimens in alcohol from Sipora, Mentawei Islands, were regarded as being the same species. While they seem to belong to the same group as *T. hypochrysa,* I have identified them with *Tupaia chrysogaster* from the geographically nearer Pagi Islands, and with which they seem to agree more closely with respect to measurements. *Tupaia hypochrysa* has many resemblances to *Tupaia longipes* and *discolor* of Borneo and Banka. *Tupaia hypochrysa* is one of the few species of treeshrews whose number of mammæ is unknown, and in this particular instance knowledge on that point is of much importance to show probable affinities. *T. chrysogaster* of the Mentawei Islands has the mammæ 1–1 = 2, while in *T. longipes* and *T. discolor* they are 3–3 = 6.

Specimens examined.—Three, the type from "Java" and a second specimen from "Java" and a third from 3,500 feet on Mount Salak, western Java. See table, page 72.

TUPAIA CHRYSOGASTER Miller.

1903. *Tupaia chrysogaster* MILLER, Smiths. Misc. Coll., vol. 45, p. 58, November 6, 1903.

Type-locality.—North Pagi Island, off southwest coast of Sumatra.

Type-specimen.—In United States National Museum, Cat. No. 121752, skin and skull of adult female collected on North Pagi Island, November 21, 1902, by Dr. W. L. Abbott; original number, 2078; in good condition.

Geographic distribution.—North and South Pagi, and Sipora of the Mentawei Islands, off the southwest coast of Sumatra. See No. 16 on map on page 75.

Diagnosis.—Above, including tail, finely grizzled, blackish and ochraceous rufous; below, clear ochraceous rufous; mammæ, 1–1 = 2.

Color.—Upper parts of head, neck, body, tail, and outerside of legs a fine grizzle of blackish and ochraceous rufous, both colors about in equal proportions; on nose the ochraceous rufous lightens to raw sienna; underside of tail similar to upper but orange ochraceous

lighter and duller, and in greater proportion than the black element; entire underparts, including inner side of legs, ochraceous rufous, much clearer than in *Tupaia hypochrysa;* hands and feet blackish brown, slightly and finely grizzled with an ochraceous color; shoulder-stripe barely indicated, sometimes practically obsolete, ochraceous rufous.

Skull and teeth.—The skull and teeth of *Tupaia chrysogaster* are essentially like those of *T. hypochrysa,* but the rostrum is distinctly slenderer, and the teeth not so large and heavy and the bullæ not so reduced; in other respects the two skulls are similar. The slenderness of the rostrum suggests the genus *Tana.* (Plate 9, fig. 9.)

Measurements.—Type: Head and body, 205 mm.; tail, 140; hind foot, 46; condylo-basal length, 51.5; zygomatic width, 27; width of brain-case, 19.5; maxillary toothrow, 20. These measurements are quite characteristic of the series, which show little individual variation. The tail is seen to be much shorter than the head and body. For individual measurements, see table below.

Specimens examined.—Thirteen; six from North Pagi, four from South Pagi, one marked simply Pagi Islands, and two from Sipora Island.

Remarks.—*Tupaia chrysogaster* is a very distinct species and needs no close comparison with any other member of the genus. It has few affinities with the treeshrews of Sumatra, the nearest land mass, but is clearly related by the size and form of its skull and color of the underparts to *Tupaia hypochrysa* of Java.

Measurements of Tupaia chrysogaster and T. hypochrysa.

Name.	Locality.	Number.	Sex.	Molar teeth worn.	Head and body.	Tail.	Hind foot.	Condylo-basal length.	Zygomatic width.	Width of brain case.	Maxillary tooth row.	Number of mammæ.
					mm.	*mm*	*mm*	*mm.*	*mm.*	*mm.*	*mm.*	
T. chrysogaster	Pagi Islands...	121580...	Male...	None [1].....	195	125	45	48	26	20.5	18.5	....
Do.....	North Pagi Island.	121571...	...do....	Much.....	197	138	44	51±	26.5	19	20	....
Do.....	.....do.....	121572 [2]..	Female	.....do.....	205	140	46	51.5	27	19.5	20	1-1
Do.....	.....do.....	121573...	...do....	.....do.....	220	140	47	52±	.....	19.5	20	1-1
Do.....	.....do.....	121574...	...do....	Slightly....	179	146	45	49.5	25.5	20.5	20	....
Do.....	.....do.....	121575...	...do....	Much.....	188	147	44	49.5	26.5	20	20	1-1
Do.....	.....do.....	121576...	...do....	Slightly....	188	145	45	51	26	20	20	1-1
Do.....	South Pagi Island.	121577...	...do....	Moderately	210	150	46	51	26.5	19.5	20	....
Do.....	.....do.....	121578...	Male?..	None [3].....	205	160	46	50.5	25.5	19.5	19.5	....
Do.....	.....do.....	121579...	Female	Slightly....	195	95	45	50	26	19.5	19.5	1-1
Do.....	.....do.....	121892 [4]..	...do....	(5).....	160±	130	43	.....	.....	.....	.....	1-1
Do.....	Sipora, Mentawei Islands.	95.1.9.2 [4].	...do....	.....	190	140	45	.....	.....	.....	.....	....
Do.....	.....do.....	Genoa [4]...	...do....	.....	210	145	45	.....	.....	.....	.....	1-1
T. hypochrysa	Java, Mount Salak, 3,500 feet.	154599...	Male...	Moderately	145	145	49	51.5	26	19.5	21	....
Do.....	Java.....	86.7.2.12 [2]	...do....	Much.....	.....	....	48	51	28	21.5	20.5	....
Do.....	.....do.....	633, Berlin.	.....	Moderately	.....	....	46	.....	27	20.5	19.5	....

[1] m^3 just level with alveolus.
[2] Type.
[3] Permanent pm^3 and pm^4 not in place.
[4] Preserved in alcohol.
[5] About three-fourths grown.

TUPAIA DISCOLOR Lyon.

1906. *Tupaia discolor* LYON, Proc. U. S. Nat. Mus., vol. 31, p. 602, December 18, 1906.

Type-locality.—Island of Banka, east of Sumatra.

Type-specimen.—In United States National Museum, Cat. No. 124703, skin and skull of adult female, collected at Tanjong Rengsam, Banka, May 24, 1904, by Dr. W. L. Abbott; original number, 3262; in good condition.

Geographic distribution.—Island of Banka. See No. 12 on map on page 75.

Diagnosis.—A treeshrew of the *T. glis ferruginea* build with the general color effect of the anterior parts rather ferruginous, and the posterior parts rather tawny olive, underparts ochraceous; mammæ, 3–3 = 6.

Color.—Upper parts of head, neck, anterior half of body, and outer side of forelegs a fine grizzle of black, and ferruginous, the latter color in excess; posterior half of upper parts, with base of tail, and outer side of hind legs a fine grizzled mixture of ochraceous buff and blackish, both colors in about equal proportions; upper surface of tail a grizzle of blackish and cream color or buff; the black being much in excess; underparts of head, neck, and body, including inner side of legs, varying from ochraceous buff to dull orange ochraceous; underside of tail similar to upper, but the lighter color in excess along its center; hands and feet blackish brown, with a very fine ochraceous grizzle; shoulder stripe well developed, orange rufous.

Skull and teeth.—These are distinctly of the *ferruginea* type, but the teeth are noticeably smaller, the bullæ larger, and brain case more rounded and inflated. (Plate 9, fig. 4.)

Measurements.—Type: Head and body, 220 mm.; tail, 175; hind foot, 48; condylobasal length, 48.5; zygomatic width, 26; width of brain case, 19; maxillary tooth row, 18.5. Except in length of tooth row and width of brain case the type has measurements slightly in excess of the majority of specimens. For individual measurements, see table, page 78.

Remarks.—*Tupaia discolor* is a very distinct form, and along with *T. longipes* of Borneo constitutes a distinct section of the genus. Although clearly of the *ferruginea* type it is very different in coloration and in number of mammæ from that form. It is clearly a derivative of the Bornean *T. longipes* and has no close affinities with *T. glis ferruginea* of Sumatra. It is described here before *T. longipes* because it is a more extreme development of the same type of animal. Although externally showing many affinities to *T. hypochrysa* of Java, yet its skull shows none of the peculiarities of that species and is distinctly of the wide ranging *ferruginea* type.

Specimens examined.—Fifteen, all from Banka—three from Klabat Bay, on the northern end, and twelve from Tanjong Rengsam, upper part of Banka Strait.

EXPLANATION OF NUMBERS ON MAP FACING.

1 *T. chinensis:* China, northern Burma.
2 *T. belangeri:* Tenasserim.
3 *T. concolor:* Anam.
4 *T. modesta:* Island of Hainan.
5 *T. lacernata wilkinsoni:* Middle of Malay Peninsula.
6 *T. glis ferruginea:* Southern Malay Peninsula, Sumatra.
7 *T. demissa:* Northern Sumatra.
8 *T. siaca:* Eastern Sumatra.
9 *T. longipes longipes:* Northern Borneo.
10 *T. longipes salatana:* Southern Borneo.
11 *T. hypochrysa:* Java.
12 *T. discolor:* Banka, east of Sumatra.
13 *T. palawanensis:* Palawan, Balabac, northeast of Borneo.
14 *T. möllendorffi:* Culion, northeast of Borneo.
15 *T. cuyonis:* Cuyo, northeast of Borneo.
16 *T. chrysogaster:* Mentawi Islands, south of Sumatra.
17 *T. castanea:* Bintang Island, south of Malay Peninsula.
18 *T. glis batamana:* Batam Island, south of Malay Peninsula.
19 *T. phœura:* Sinkep Island, between Malay Peninsula and Sumatra.
20 *T. tephrura:* Tana Bala, southwest coast of Sumatra.
21 *T. glis glis:* Penang Island, west coast, southern Malay Peninsula.
22 *T. picta:* Northern Borneo.
23 *T. lacernata lacernata:* Lankawi, Terutau, west coast Malay Peninsula.
24 *T. lacernata raviana:* Butang Islands, west coast, Malay Peninsula.
25 *T. montana montana:* Mount Dulit, Northern Borneo.
26 *T. montana baluensis:* Mount Kina Balu, northeastern Borneo.
27 *T. dissimilis:* Condore Island, off Cochin China.
28 *T. glis sordida:* Tioman Island, east of southern Malay Peninsula.
29 *T. glis pemangilis:* Pemangil Island, east of southern Malay Peninsula.
30 *T. glis pulonis:* Aor Island, east of southern Malay Peninsula.
31 *T. lucida:* Pulo Laut, north of west end of Borneo.
32 *T. natunæ:* Bunguran Island, north of west end of Borneo.
33 *T. chrysomalla:* Siantan Island, between southern Malay Peninsula and Borneo.
34 *T. riabus:* Riabu Island, between southern Malay Peninsula and Borneo.
35 *T. anambæ:* Jimaja Island, between southern Malay Peninsula and Borneo.
36 *T. carimatæ:* Karimata Island, southwest coast of Borneo.
37 *T. splendidula:* Southern Borneo.
38 *T. lacernata longicauda:* Perhentian Island, east coast of Malay Peninsula.
39 *T. lacernata obscura:* Redang Island, east coast of Malay Peninsula.
40 *T. nicobarica nicobarica:* Great Nicobar Island, northwest of Sumatra.
41 *T. nicobarica surda:* Little Nicobar, northwest of Sumatra.

TUPAIA LONGIPES Thomas.

(Synonymy under subspecies.)

Geographic distribution.—Borneo. See Nos. 9 and 10 on map on page 75.

Diagnosis.—Similar to *Tupaia discolor* of Banka, but larger and with less contrast in color between anterior and lower portions of back; mammæ, 3–3 = 6.

MAP OF THE MALAY REGION, SHOWING THE DISTRIBUTION OF THE FORMS OF THE GENUS TUPAIA, EXCEPTING THE MEMBERS OF THE GRACILIS, JAVANICA, AND MINOR GROUPS.

Color.—Upper parts of head, neck, and anterior half of body and outer side of forelegs a fine grizzle of black and tawny, the latter color in excess; posterior portions of upper parts including base of tail, and outer side of hind legs a fine grizzly mixture of ochraceous buff and blackish, both colors in about equal proportions; upper surface of tail blackish brown faintly grizzled with a buff-like color; undersurface of tail similar, but the buffy color predominating in the middle line; anterior half of underparts light orange ochraceous, posterior portions dull buffy, inner side of legs similar to adjacent portion of underparts, but colors duller; feet blackish brown with a very few light specks.

Skull and teeth.—Of the same general form as in *Tupaia glis ferruginea*, but slightly larger throughout and very similar to the skull of *T. discolor*, with a similar inflation of the brain case and rather enlarged ballæ, but the skull and teeth as a whole decidedly larger than in *discolor*.

Measurements.—Head and body, 200 mm., or slightly more; tail, 190; hind foot, 50–53; condylobasal length, 48–52; zygomatic width, 26–28; width of brain case, 20–21; maxillary tooth row, 19–21.

Forms.—*Tupaia longipes* is separable into two fairly well marked forms, *T. longipes longipes* from northern Borneo, and a form from southern Borneo described below as new.

TUPAIA LONGIPES LONGIPES Thomas.

1893. *Tupaia ferruginea longipes* THOMAS, Ann. Mag. Nat. Hist., ser. 6, vol. 11, p. 343, May, 1893.
1911. *Tupaia longipes*, LYON, Proc. U. S. Nat. Mus., vol. 40, p. 122, April 25, 1911.

Type-locality.—Northwestern Borneo.

Type-specimen.—In British Museum, Reg. No. 76.9.20.5, collected in 1876, by H. Low.; a fairly well made skin in good condition; skull with the occipital portion cut away after the manner of bird collectors.

Geographic distribution.—Northern Borneo, specimens from Sarawak to Mount Kalulong. See No. 9 on map on page 75.

Diagnosis.—Tail and lower back more brownish, and less gray than in the southern subspecies, and less contrast in color between anterior and posterior portions of body; maxillary tooth row usually over 20 mm. in length.

Measurements.—Type: Hind foot, 51 mm.; zygomatic width, 27; width of brain case, 20.5; maxillary tooth row, 21. For measurements of other specimens, see table, page 77.

Specimens examined.—Twelve, from northern Borneo. For exact localities, see table, page 77.

TUPAIA LONGIPES SALATANA, new subspecies.

Type-locality.—Pangkallahan River, S. E. Borneo, 15 miles from mouth.

Type-specimen.—In U. S. National Museum, Cat. No. 151882, collected along Pangkallahan River February 11, 1908, by Dr. W. L. Abbott; original number, 5785; skin in good condition; skull damaged by shot in basal occipital region.

Geographic distribution.—Southern Borneo, specimens from Kendawangen River region and Pangkallahan River. See No. 10 on map on page 75.

Diagnosis.—Differs from the northern race in having more contrast in color between anterior and posterior portions of back, more rufescent on the shoulders than is *T. l. longipes* and less than *T. discolor;* general effect of lower back and tail is much like clove brown, while in the northern race it is more like bistre; not so light on the lower back as is *T. discolor;* maxillary tooth row less than 20 mm. in length. (Plate 9, fig. 5.)

Measurements.—Type: Head and body, 213 mm.; tail, 185; hind foot, 50; condylobasal length, 45; zygomatic width, 25.5; width of brain case, 20.5; maxillary tooth row, 19.5. For measurements of four other individuals, see table below.

Specimens examined.—Five; four from southwestern and one from southeastern Borneo. An old mounted specimen is in the Paris Museum, numbered 21, and marked simply "Borneo," collected by Temminck in October, 1842, hind foot measuring about 45 mm. It may possibly belong to the present subspecies.

Measurements of Tupaia longipes and Tupaia discolor.

Name.	Locality.	No.	Sex.	Molar teeth worn.	Head and body.	Tail.	Hind foot.	Condylo-basal length.	Zygomatic width.	Width of brain case.	Maxillary tooth row.	Number of mammæ.
					mm.	*mm.*	*mm*	*mm*	*mm*	*mm*	*mm*	
T. longipes salatana.	Borneo, Batu Jurong.	153852	Male	Slightly	205	195	49	48	25.5	21.5	19	....
Do	do	153853	do	None [1]	192	205	51	45.5	25	20	18	....
Do	Borneo, Kendawangan River.	153854	Female	do.[1]	190	180	50	46.5	25	21	19	....
Do	do	153855	Male	Slightly [2]	213	190	53	49	26	21	19	....
Do	Borneo, Pangkallahan River.	151882 [3]	do	Moderately	213	185	50	49±	25.5	20.5	19.5	....
Do	Borneo [4]	Paris, 21					45±					
T. longipes longipes.	Baram River, Sarawak.	92.2.7.20	Male	Much			51	50			19.5	....
Do	Baram, Sarawak.	0.8.4.7	do	do			53	52	28	21	20.5	....
Do	Kalulong, Sarawak.	8.1.27.2	do	Moderately			53	49.5	....	20	21	....
Do	Spitang, North Borneo.	92.9.6.1	do	do			49	49	27	21	20	....

[1] Permanent *pm* [3] and *pm* [4] not yet in place.
[2] i^1 and i^2 not fully in place.
[3] Type.
[4] Collected by Temminck, October, 1842.

Measurements of Tupaia longipes and Tupaia discolor—Continued.

Name.	Locality.	No.	Sex.	Molar teeth worn.	Head and body.	Tail.	Hind foot.	Condylo-basal length.	Zygomatic width.	Width of brain case.	Maxillary tooth row.	Number of mammæ.
					mm.	*mm.*	*mm*	*mm*	*mm*	*mm*	*mm*	
T. longipes longipes.	Northwest Borneo.	76.9.20.5 [1]	.....	Moderately	.....	.....	51	....	27	20.5	21	....
Do	Sarawak	93.4.1.37	Male	Adult	215	205	54	....	....	....	....	....
Do	Baram River	Berlin	Female	Skull inside	.....	.....	53	....	....	....	....	....
Do	Sarawak [2]	Genoa [3]	Male	.....	195	195	53	....	....	....	....	....
Do	do. [2]	Genoa [3]	do	.....	160	165	51	43	24	20.5	....	....
Do	do. [2]	Genoa 3b [4]	Female	Moderately	190±	165±	50±	51.5	27	21	21	3-3
Do	do. [2]	Genoa 3a [4]	Male	.....	190±	155±	50±	....	....	....	....	....
Do	do. [2]	Genoa 3d [5]	.....	None [6]	200±	155±	52	47.5	26	21	20	....
T. discolor	Banka, Klabat Bay.	124903	Female	None [7]	170	155	48±	41.5	23.5	19.5	18±	....
Do	do	124904	do	Moderately	210	162	46	48	25.5	19	18.5	3-3
Do	Banka, Tanjong Rengsam.	124700	Male	Slightly	203	177	48	47	25.5	19.5	19	....
Do	do	124701	do	Moderately [8]	205	187	48	47	25.5	19.5	18.5	....
Do	do	124702	do	do	200	.....	48	46.5	25 [9]	20	18	....
Do	do	124705	do	do	203	187	48	46	25	19.5	18	....
Do	do	124706	do	do	200	180	48	47	25.5	20	19	....
Do	do	124704	Female	Much	203	180	49	47	25	19.5	19	3-3
Do	do	124707	do	Slightly	192	170	46	45.5	24	19.5	19	3-3
Do	do	124703 [1]	do	Moderately	220	175	48	48.5	26	19	18.5	3-3
Do	do	124708	do	do	.....	.....	...	47.5	25	19.5	18.5	....
Do	do	124697 [3]	Male	(8)	195±	170	47	....	....	....	....	....
Do	do	124698 [3]	Female	(8)	225±	170	47	....	....	....	....	3-3
Do	Banka, Klabat Bay.	124905 [3]	Male	(8)	200±	160	48	....	....	....	....	....
Do	Banka, Tanjong, Rengsam.	9.8.16.1	Female	Moderately	210	175	49	47	25.5	20	19	2-2

[1] Type.
[2] Collected by Doria and Beccari.
[3] Preserved in alcohol.
[4] Mounted.
[5] Skeleton.
[6] *dpm*^{4} still in place.
[7] m^2 last tooth through.
[8] Nearly adult.
[9] Adult.

TUPAIA PALAWANENSIS Thomas.

1894. *Tupaia ferruginea palawanensis* Thomas, Ann. Mag. Nat. Hist., ser. 6, vol. 13, April, 1894.

Type-locality.—Palawan, Philippine Islands.

Type-specimen.—In British Museum, Reg. No. 94.2.1.3; skin and skull of adult male, collected on Palawan by A. Everett; skin in good condition, but skull slightly damaged in occipital and palatal regions.

Geographic distribution.—Islands of Palawan and Balabac, and probably other near-by islands. See No. 13 on map on page 75.

Diagnosis.—Generally similar in color to *T. glis ferruginea*, but tail when viewed from above clear black or nearly so; mammæ, 2–2 = 4.

Color.—Type: Upper parts of head, neck, and body a rather coarse grizzle of blackish and ochraceous or ochraceous rufous, the ochraceous being more conspicuous anteriorly and the ochraceous rufous posteriorly, the black element of the grizzle being somewhat in excess, especially along the middle line; underparts dull buff or

ochraceous buff; outer and inner side of legs similar to adjacent parts of body; feet similar to legs, but toes distinctly blackish; upper side of tail clear blackish; underside similar except for tawny ochraceous annulations on either side of the middle line and toward the base.

Not all specimens are as strongly characterized as the type; in most of them the tail is not clear black above, in some cases being blackish brown and nearly always with some fine ochraceous dots or annulations showing on the upper surface. Two specimens, Reg. No. 94.2.1.4 and 97.9.12.1, are very similar to the type in color, but the specimens from Puerto Princessa in the Paris Museum are similar to *Tupaia chinensis*, but are darker above, and with distinctly darker tails.

Skull and teeth.—These do not show any distinguishing characteristics, being generally like those of *Tupaia glis ferruginea*.

Measurements.—Type: Head and body (from dried skin), 210 mm.; tail (from dried skin), 185; hind foot, 45; condylo-basal length, 50; zygomatic width, 26.5; width of brain case, 18.5; maxillary tooth row, 18. Measurements of other specimens fully as old as the type are essentially the same except that the condylo-basal length is much shorter in some, as small as 43 mm., and the hind foot is seldom as long. For individual measurements see table, page 80.

Remarks.—As represented by the type-specimen *Tupaia palawanensis* is a very distinct form, and quite different from its geographic neighbor, *T. longipes*, of Borneo. *T. longipes* is finely grizzled on the upper parts, and its tail is essentially like the back in color, while *T. palawanensis* is coarsely grizzled, and its black tail is very different in appearance from the back. While I have not been able to compare the Puerto Princessa specimens directly with the type of *T. palawanensis*, yet as far as can be told from memory they seem very different in general style of coloration from the type. Although the tails are darker than the upper parts they do not appear black, and the difference in condylo-basal length 50 in the type and 43 mm. in a Puerto Princessa specimen with moderately worn teeth is considerable. It is barely possible that more than one form of *Tupaia* may occur on Palawan. It is to be noted also that the exact locality of the type does not appear to be known, the specimen being labeled simply "Palawan." This species or a related one occurs on Balabac, represented by British Museum, Reg. No. 94.7.2.55, a nearly adult female preserved in alcohol. Owing to its immaturity and manner of preservation it is not possible to say whether it is *T. palawanensis* or some other form. Another specimen in the British Museum, not numbered, collected by W. Doherty, is marked "Palawan or Basilan," is not particularly different from *T. palawanensis*, and for the time

being at least it seems best to regard it as having come from Palawan. In the Berlin Museum is a specimen collected by Möllendorf, agreeing very well with *T. palawanensis*. It is labeled "Calamianes Gruppe." If not coming from northern Palawan itself, it probably came from some of the nearer islands at the northern end of Palawan. This specimen was called by Nehring,[1] in 1894, *T. ferruginea*. The specimen appears to be an old one and to have been mounted at one time. The same name was applied to the British Museum specimens in 1889 by Everett.[2]

Specimens examined.—Eighteen; 6 including the type from "Palawan"; 6 from Puerto Princessa, Palawan; 3 from Iwahig, Palawan; 1 from the "Calamianes Gruppe"; 1 from Balabac; and 1 from "Palawan or Basilan." See table below.

Measurements of Tupaia palawanensis.

[B. M.=British Museum, London; P. M.=Philippine Museum, Manila; A. M. N. H.=American Museum of Natural History, New York.]

Locality.	Number.	Sex.	Molar teeth worn.	Head and body.	Tail.	Hind foot.	Condylo-basal length.	Zygomatic width.	Width of brain case.	Maxillary tooth row.	Mammæ.
				mm.	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	
Palawan	94.2.1.3 [3]	Male	Slightly	210±	185±	45	50	26.5	18.5	18	....
Do	94.2.1.5		None [4]	180±	150±	45	37.5	21	18.5	....	....
Do	91.11.28.1		do.[5]	.....	.....	43	44	.....	.....	17	....
Do	76.10.4.6		do.[6]	160±	135±	40	.....	.....	20	....	....
Do	7.99.12.1 [7]		Moderately	.....	.....	42	47.5	.....	19	18	....
Do	94.2.1.4	Female	Slightly	210±	185	45	46	.....	19	17.5	2-2
Palawan or Basilan	B. M. no no.; W. Doherty, collector.		None	190	150	40	.....	.....	.....	19.5	....
Balabac	94.7.2.55	Female	([8])	180	150	43	.....	.....	.....	.....	....
Palawan, Puerto Princesa.	79.5.3.10	Male	([9])	165	145	44	.....	.....	.....	.....	....
Do	98 P. M.	Female	Slightly [10]	148±	148±	43	44.3	22.5	19	16.7	2-2
Palawan, Iwahig	A. M. N. H. 29725.		Moderately	.....	.....	.....	.....	25	18.5	17.5	....
Do	29726		None [11]	.....	.....	.....	.....	.....	20±	17±	....
Do	29724		Much	.....	.....	.....	.....	.....	.....	17.5	....
Palawan, Puerto Princesa.	Paris, 234		Moderately	190±	175±	41±	.....	25	21	17	....
Do	Paris, 1282		do	200±	160±	40±	.....	24	18.5	17	....
Do	Paris, 22		None	210±	170±	42±	43	.....	18.5	18	....
Do	Paris, 1281	Female	Moderately	205±	155±	42±	43	23	18	17	2-2
"Calamianes Gruppe."	13908, Berlin [12]		Skull in skin.	.....	.....	42	.....	.....	.....	.....	....

[1] Sitz.-Ber. Ges. nat. Freunde, Berlin, 1894, No. 8, p. 184.
[2] Proc. Zool. Soc. London, 1889, p. 223.
[3] Type.
[4] pm^2 just appearing.
[5] m^3 half way up.
[6] pm^2 half way up.
[7] Mounted specimen.
[8] Nearly adult preserved in alcohol.
[9] Deciduous incisors still in place, preserved in alcohol.
[10] Deciduous incisors still in place, permanent *i* appearing.
[11] m^3 just appearing.
[12] Obtained by Möllendorf probably from natives, mentioned by Nehring as *T. ferruginea*. Specimen rather old and once mounted.

TUPAIA MÖLLENDORFFI Matschie.

1898. *T[upaja] möllendorffi* MATSCHIE, Sitz.-Ber. Ges. nat. Freunde, Berlin, 1898, p. 39.

Type-locality.—Culion (also called Calimian), a small island north of Palawan, Philippine Islands.

Type-specimen.—In the Royal Zoological Museum, Berlin, No. 9858, skin and skull of adult male, collected on Culion, Philippine Islands, by Dr. von Möllendorff; skin in good condition, but posterior parts of the skull are lacking.

Geographic distribution.—Island of Culion and possibly some of the immediately adjacent islands. See No. 14 on map on page 75.

Diagnosis.—Upper parts finely grizzled ochraceous and blackish, tail coarsely black and buff, different, that is grayer, in color from rest of upper parts. Mammæ, 2–2 = 4.

Color.—Upper parts and sides of head, neck, and body a fine grizzle of ochraceous (or ochraceous buff), and blackish, the lighter color being slightly in excess, expecially along the sides and rump; underparts, including throat and inner side of legs, usually dirty buff, or ochraceous buff; in the type the chin and throat, cream buff, distinctly lighter than rest of underparts; outer side of legs essentially like upper parts of body; feet similar, but the grizzle very fine, and the dull ochraceous buff color predominating; shoulder stripe fairly well defined, buffy; tail a coarse grizzle of buff and blackish, both above and below, the blackish color slightly in excess above, and the buff below; tail from above with a distinctly grayer look than rest of upper parts, and noticeably different in color.

Skull and teeth.—The skull of *Tupaia möllendorffi* is smaller than that of *T. glis ferruginea*, relatively shorter, wider, with a relatively thicker rostrum which arises more abruptly from rest of skull. Aside from their slightly smaller size and relatively greater development of the central upper incisors the teeth of *T. möllendorffi* are not essentially different from those of *T. glis ferruginea*.

Measurements.—Type: Head and body (dried skin), 200 mm.; tail, (dried skin), 160; hind foot, 43; zygomatic width, 24; width of brain case, 18; maxillary tooth row, 16.5. For measurements of three other specimens see table, page 83.

Remarks.—*Tupaia möllendorffi* is quite different and apparently very distinct from its geographic neighbor, *T. palawanensis*. It is smaller and its external appearance quite different from the typical Palawan form. When compared with the Puerto Princesa (Palawan) specimens it is not so distinct, but its lighter colored tail serves to distinguish it easily. It was identified by Nehring[1] in 1894 as *Tupaia ferruginea*.

Specimens examined.—Four. See table, page 83.

[1] Sitz. Ber. Ges. naturf. Freunde, Berlin, 1894, p. 184.

TUPAIA CUYONIS Miller.

1910. *Tupaia cuyonis* MILLER, Proc. U. S. Nat. Mus., vol. 38, p. 393, August 19, 1910.

Type-locality.—Cuyo Island northeast of Palawan, Philippine Islands.

Type-specimen.—In the collection of the Philippine Museum, Manila, Philippine Islands, No. 26, skin and skull of adult male, collected on Cuyo Island January 15, 1903, by R. C. McGregor and A. Celestino; in good condition.

Geographic distribution.—Known only from the Cuyo Island. See No. 15 on map on page 75.

Diagnosis.—Similar to *Tupaia möllendorffi;* head and body of a uniformly grizzled ochraceous and black coloration, but tail not different in color from lower back. Mammæ, 2–2 = 4.

Color.—Type: Upper parts and sides of head, neck, and body a fine grizzle of ochraceous and black, the lighter color being slightly in excess, especially along the sides and rump; under parts, including throat and inner side of legs, generally ochraceous, darker anteriorly and approaching buff posteriorly, the dark bases of the hairs showing through, giving an ill-defined grizzled appearance; outer side of legs essentially like the body, the feet similar, but grizzling finer; shoulder stripe ill defined, buff in color; tail above and below a coarse grizzle of ochraceous and blackish, the darker color slightly in excess above and the lighter color below.

Skull and teeth.—These are without special peculiarities, distinctly smaller than those of *T. glis ferruginea;* brain case relatively wide, rostrum rather short and heavy, arising rather abruptly from rest of skull. The hypocones of the first and second molars are very poorly developed. (Plate 9, fig. 1.)

Measurements.—Type: Head and body, 154 mm.; tail, 166; hind foot, 41; condylo-basal length, 43; zygomatic width, 24.4; width of brain case, 18; maxillary tooth row, 16.5. The external measurements of the type are somewhat less than those of the majority of specimens, but the cranial measurements are characteristic. For individual measurements see page 83.

Remarks.—The two species just described, *T. möllendorffi* and *T. cuyonis,* are closely related forms but easily distinguished by the tail being grayer than rest of upper parts in the one case and by its being of generally the same color as the lower back in the other case. They appear more closely related to one another than either of them does to *T. palawanensis.* The skulls of the two forms are essentially alike. There are many things about *Tupaia cuyonis* to suggest *T. javanica.* The two are not so very different in size, especially when the skulls are compared. The skulls have the same general shape in the two species. The development of the central upper incisors and lower canines is distinctly greater than in most members of the genus, but on the whole rather less than what one finds in good

specimens of *Tupaia javanica*. *T. cuyonis* also resembles *T. javanica* in having dark under parts. *T. cuyonis* might with much propriety be described as a large brown and not olivaceous *T. javanica*. The difference between the length of tooth row and the width of brain case is greater in *Tupaia cuyonis* than it is in *T. chinensis* or *T. belangeri*, and still greater than in *T. glis ferruginea*, where the maxillary tooth row is sometimes as long as the brain case is wide. In *T. javanica* the difference in length of maxillary tooth row and width of brain case is even greater than in *T. cuyonis*. *Tupaia cuyonis* and *T. möllendorffi* are very distinct from each other and from other members of the genus, but at the same time they have no sharply separating characters. They have characters which on the one hand ally them with *T. javanica* and on the other with *T. chinensis*.

Specimens examined.—Nine, all from Cuyo Island, and in the collection of the Philippine Museum. See table below.

Measurements of Tupaia möllendorffi and T. cuyonis.

Name.	Locality.	Number.	Sex.	Molar teeth worn.	Head and body.	Tail.	Hind foot.	Condylo-basal length.	Zygomatic width.	Width of brain case.	Maxillary tooth row.	Number of mammæ.
					mm	*mm*	*mm*	*mm*	*mm*	*mm*	*mm*	
T. möllendorffi.	Culion Island, Philippine Islands.	2 P. M.[1]	Male	Slightly	164	166	46	43.0	23.0	18.5	16.7	....
Do	do	3 do.[1]	Female.	None [2]	147	147	40	40.7	22.2	18.0	15.4	2-2
Do	do	9858, Berlin[3]	Male	Moderately.	200±	160±	43±	....	24.0	18.0	16.5	....
Do	Unknown	No no., Berlin.	....	Slightly	205±	165±	41±	....	....	....	17.0	....
T. cuyonis.	Cuyo, Philippine Islands.	1 P. M.[1]	Male	Moderately.	176	164	42	43.7	24.5	18.0	16.5	....
Do	do	22 do.[1]	Female.	Slightly	146	154	41	42.4	23.6	18.0	16.0	2-2
Do	do	23 do.[1]	Male	do	165	155	43	43.6	24.6	18.5	16.0	....
Do	do	24 do.[1]	do	Moderately.	145	174	42	43.8	25.0	18.5	16.0	....
Do	do	25 do.[1]	do	Slightly	160	166	41	43.7	24.6	18.5	16.0	....
Do	do	26 do.[1 3]	do	Moderately.	154	166	41	43.0	24.4	18.0	16.5	....
Do	do	41 do.[1]	do	Slightly	157	152	42	43.3	24.0	18.5	16.5	....
Do	do	42 do.[1]	Female.	do.[2]	165	175	42	41.9	22.4	18.5	16.0	2-2
Do	do	43 do.[1]	Male	do	166	164	42	43.8	24.5	18.0	16.0	....

[1] Philippine Museum. [2] *di*[1] still in place and *i*[1] just appearing. [3] Type.

TUPAIA SPLENDIDULA Gray.

1865. *Tupaia splendidula* Gray, Proc. Zool. Soc. London, 1865, p. 322, pl. 12, entire animal in colors.

1867. *Tupaia ruficaudata* Mivart, Journ. Anat. Physiol., vol. 1, p. 293, footnote, 1867. (Same type-specimen and locality as *T. splendidula* above.) A publication of Gray's manuscript name.

1879. *Tupaia splendidula*, Anderson, Zool. Res. West. Yunnan, p. 132, pl. 7, figs. 10 and 11, skull, 1879.

1894. *Tupaia splendidula*, Thomas and Hartert, Nov. Zool., vol. 1, p. 656, September, 1894.

1896. *Tupaja mülleri* Kohlbrugge, Natuurk. Tijdschr. Nederl.-Indië, vol. 55 (ser. 9, 4), p.196. 1896. (Type-locality, Banjermassin, southeastern Borneo.)

Type-locality.—Borneo, probably.

Type-specimen.—This species was based upon two specimens in the British Museum, one of them in alcohol from Borneo, Reg. No.

48.2.11.2, and a skin and skull without locality, Reg. No. $\frac{47.7.8.13}{48.1.27.14}$. From the account in the original description one would be inclined to take the specimen in alcohol as the type, but because a colored plate of the entire animal is given, one is justified in regarding the skin as the type. This has been done by authors generally, Mivart, Anderson, and Thomas.[1] This course is rendered imperative by the fact that an examination of the specimen in alcohol shows it to be an immature example of *Tana tana*, the first upper molar not being through the gum, and just appearing through the alveolus. The skin, Reg. No. 47.7.8.13, is mounted and in good condition, probably a female; the only original information concerning it is "Ex. coll. Verreaux."[1] The skull, Reg. No. 48.1.27.14, is in fairly good condition, but considerably damaged on the right side about the palate.

Geographic distribution.—Probably the entire island of Borneo, but known records are only from southern portion. See No. 37 on map on page 75.

Diagnosis.—About the size of or slightly smaller than *T. glis ferruginea*, upper parts seal or walnut brown, tail similar to body, its hairs without annulations. Mammæ, probably 2–2 = 4.

Color.—General color effect above something between seal brown and walnut brown, with indistinct grizzling with ferruginous posterior to neck, becoming almost obsolete on the rump, anterior to the neck color lighter and grizzling more distinct; in the type, top of neck and shoulders and sides something of a color between bay and chestnut; under parts anterior to chest, buffy in the type, ochraceous buffy in other specimens, posterior to chest tawny ochraceous; tail above similar to back, below tawny in center line, outer edges like back, hairs of tail without annulations; shoulder stripe rather poorly defined, tawny ochraceous.

Skull and teeth.—The skull and teeth of *Tupaia splendidula* are of the same general form as those of *T. glis ferruginea*, but are distinctly smaller, with smaller and more oval incisive foramina, and relatively larger orbits. The type has a slightly wider rostrum and wider brain case than Cat. No. 151883, U.S.N.M. (Plate 10, fig. 11.)

Measurements.—Type: Head and body, 190 mm.; tail, 140 (both from mounted skin); hind foot, 40; condylo-basal length, 45; zygomatic width, estimated, 27; width of brain case, 18; maxillary tooth row, 17.5. Collector's measurements of head and body are 173–188; tail, 130–157. Measurements of two adult skulls are: Condylo-basal length, 43.5–44; zygomatic width, 24.5–24.5; width of brain case, 18–18.5; maxillary tooth row, 16.5–18. See table, page 87.

Remarks.—*Tupaia splendidula* is a well-characterized species and representative of a rather definitely marked group. As seen on Borneo and as represented by geographic forms in the Natuna Islands, it is very different from members of the wide ranging *ferruginea* group, yet it seems to be not very distantly removed from it.

[1] See Thomas and Hartert, Nov. Zool., vol. 1, p. 656, September, 1894.

Its chief distinguishing feature is the lack of annulations on the hairs of the tail, generally dark color, and the small size of skull. On Sumatra, Singkep, and the Anamba Islands are Tupaias which, while evidently belonging to this *splendidula* group, are much closer to *T. glis ferruginea* than is *T. splendidula* itself. I have not seen Kohlbrugge's *Tupaia mülleri*, but the description would indicate it to be an example of *T. splendidula*. Neither have I seen *Glipora rufescens* "b" and "c" of Jentink's Catalogue,[2] judging by the name they may be examples of this species. Mivart's *Tupaia ruficaudata* was an accidental publication of Gray's manuscript name. Gray had evidently intended to call the species *ruficaudata*, but really published the name as *splendidula*, forgetting to change *ruficaudata* on the label of the specimen. As Kohlbrugge points out, attention to this species was first called by Müller and Schlegel[1] who considered it a hybrid between "*Hyl. tana* and *ferruginea*." Not unlikely it is specimen "*d*" under *Tupaia ferruginea* from Banjermassin in Jentink's catalogue of mammals in the Leyden Museum.[2] In the Berlin Museum is a skull without skin from Kutei, a district on the east coast of Borneo somewhat north of Klumpang Bay, where Doctor Abbott collected two examples. I have identified it as *Tupaia splendidula*, but not without some reservation, as I was unable to make a direct comparison with known *splendidula* skulls.

Specimens examined.—Five, four from southern Borneo, and one, the type, probably from Borneo. See table, page 87.

TUPAIA NATUNÆ Lyon.

1895. *? Tupaia splendidula typica* THOMAS and HARTERT (*nomen nudum*), Nov. Zool., vol. 2, p. 489, December, 1895.

1911. *Tupaia natunæ* LYON, Proc. Biol. Soc. Wash., vol. 24, p. 168, June 16, 1911.

Type-locality.—Bunguran, Natuna Islands, north of Borneo.

Type-specimen.—In United States National Museum, Cat. No. 104714, skin and skull of an adult female, collected on Bunguran, Natuna Islands, June 27, 1900, by Dr. W. L. Abbott; original number, 514; in good condition.

Geographic distribution.—Bunguran Island. See No. 32, on map on page 75.

Diagnosis.—Similar to *Tupaia splendidula* of Borneo, but differing in a generally brighter and more reddish coloration of the upper parts, sides, legs, and tail, and more inflated braincase; mammæ, 2–2 = 4.

Color.—Type: General color of upper parts of neck and body, in fresh pelage, slightly brighter than burnt sienna, being produced by a wide band on most of the hairs, of a bright ferruginous burnt sienna mixture, with blackish bases and a considerable number of long blackish hairs; on rump, in old pelage, general color darker and

[1] Verh. Nat. Gesch. Nederl. Overz. Bezitt., p. 164, 1839–44.

[2] Mus. Hist. Nat. Pays-Bas, Cat Syst., vol. 12, 1888, p. 117.

duller; sides of body and outer side of legs similar to upper parts, but slightly grizzled; top of nose a grizzle of raw sienna and blackish gradually blending on top of head with color of upper parts; under parts buff to olive buff; inner side of legs similar to sides of body, but lighter; tail above like back, under side of tail and bases of tail hairs generally tawny ochraceous, with outer and terminal margins of tail below, dark tawny; shoulder stripe buff, or ochraceous buff. Cat. No. 104715, U.S.N.M., has the central portion of the tail orange ochraceous in color, being fully as bright as the tail of *T. lucida*.

Skull and teeth.—These are of the same general form as they are in *Tupaia splendidula*, but the skull averages longer and has a more inflated braincase; the teeth are larger. (Plate 10, fig. 12.)

Measurements.—Type: Head and body, 184 mm.; tail, 140; hindfoot, 40; condylobasal length, 46; zygomatic width, 25; width of braincase, 19; maxillary toothrow, 18. For measurements of individuals, see table, page 87.

Remarks.—*Tupaia natunæ* is closely related to *T. splendidula*, so much so that Thomas and Hartert in 1894[1] considered them the same species. At that time there were no definite records of *Tupaia splendidula* from the island of Borneo, the only available material being the type of unknown locality. They arrived at the conclusion that the type had not been obtained on Borneo, but had probably come from the Natuna Islands. Since Doctor Abbott has obtained specimens on Borneo almost identical with the type there can be but little doubt that it was originally collected on that island.[2] In working with the treeshrews in 1904 Mr. Miller in manuscript notes had come to the conclusion that the Bunguran *splendidula* was distinct from true *splendidula* and had applied the name *natunæ* to it.

Specimens examined.—Six. All from Bunguran. See table, page 87.

TUPAIA LUCIDA Thomas and Hartert.

1895. *Tupaia splendidula lucida* Thomas and Hartert, Nov. Zool., vol. 2, p. 490, 1895.

1901. *Tupaia lucida*, Miller, Proc. Wash. Acad. Sci., vol. 3, p. 133, March 26, 1901.

Type-locality.—Pulo Laut, North Natuna Islands.

Type-specimen.—In the Tring Museum, skin and skull of female, collected on Pulo Laut, by Ernest Hose, September, 1894. I have not seen this type.

Geographic distribution.—Pulo Laut, North Natuna Islands. See No. 31 on map on page 75.

Diagnosis.—A member of the *splendidula* group of *Tupaia*, but upper parts, including tail, bright tawny; mammæ, 2–2 = 4.

Color.—Based on topotypes in the United States National Museum, and a paratype in the British Museum, Reg. No. 95.11.8.7. Upper

[1] Nov. Zool., vol. 1, p. 656, September, 1894.

[2] See remarks by Thomas in Lyon, Proc. U. S. Nat. Mus., vol. 40, p. 122, April 25, 1911.

parts of body, tail, and outer side of legs bright tawny, with a very slight admixture of blackish or black; head ochraceous finely sprinkled with blackish; underparts dull ochraceous buff; underside of tail similar to upper surface, but brighter in color, and in the middle line lightening almost to ochraceous buff; shoulder stripe, moderately distinct, dull ochraceous.

Skull and teeth.—These do not appear to differ essentially from those of *Tupaia splendidula.*

Measurements.—Type (from original description): Head and body, 210 mm.; tail, 154; hind foot (without claws), 39. Usual measurements of adults: Head and body, 170–180; tail, 145–155; hind foot, with claws, 40–44; condylobasal length, 44–46; zygomatic width, 24–25; width of brain case, 18.5–19; maxillary toothrow, 18–19. For individual measurements, see table below.

Remarks.—*Tupaia lucida* is a very distinct member of the *splendidula* group, at once distinguished from the Bornean form by its much lighter and brighter color. It is a much more highly differentiated form than *T. natunæ,* probably owing to the smaller size of the island it inhabits, and the greater distance of the island from Borneo.

Specimens examined.—Eight. All from Pulo Laut. See table below.

Measurements of Tupaia splendidula, natunæ, and lucida.

Name.	Locality.	Number.	Sex.	Molar teeth worn.	Head and body.	Tail.	Hind foot.	Condylo-basal length.	Zygomatic width.	Width of brain case.	Maxillary tooth row.	Number of mammæ.
					mm	*mm*	*mm*	*mm*	*mm*	*mm*	*mm*	
T. splendidula.	Borneo; Klumpang Bay.	151883	Male	Moderately	180	130	40	43.5	24.5	18	18	....
Do	do	151884	do		173	150	42					
Do	Borneo; Kendawangan River.	153856 [1]	Female	Slightly	188 [2]	157 [2]	[2] 44	44.5	24.5	18.5	16.5	....
Do	Probably Borneo.	47.7.S.13 [3]	Female?	Moderately	190±	180±	40	45	27±	18	17.5	....
Do	Borneo; Kutei	No no., Berlin.		do	(1)			45	25	18.5	17	....
T. natunæ	Natuna Islands; Bunguran.	104714 [3]	Female	Much	184	140	40	46±	25	19	18	2–2
Do	do	104715	do	None [4]	178	140	43	46.5	23	18.5	18	....
Do	do	95.11.8.5	Male	Slightly			41		24.5	19	18.5	....
Do	do	95.11.8.6	Female	Moderately			42	48.5	25	19	18.5	2–2
Do	do	94.9.28.38 [5]	Male		200	140	43					
Do	do	94.9.28.37	Female		185	135	44					2–2
T. lucida	Natuna Islands; Laut.	104716	Male	Moderately	171	159	42	46.5	25	19	18.5	....
Do	do	104717	do	Much	184		44	45.5	25	19	18	....
Do	do	104718	Female	Moderately	178	146	43	46.5	25.5	18.5	18	2–2
Do	do	104719	Male	Much	178	152	44	46		18.5	19	....
Do	do	104720	Female	None [6]	178	146	42	44	23	18.5	19	....
Do	do	104721 [5]	do	(7)	175±	140	42					
Do	do	104722 [5]	do	(8)	145±	115	39					
Do	do	95.11.8.7 [9]	do	Much			40	43.5	24	18.5	18.5	2–2

[1] Skull only.
[2] Collector's measurement.
[3] Type.
[4] Permanent pm^3, pm^4 not in place.
[5] Preserved in alcohol.
[6] Permanent pm^4 just appearing.
[7] About two-thirds grown.
[8] About one-half grown.
[9] Paratype.

TUPAIA CHRYSOMALLA Miller.

1900. *Tupaia chrysomalla* MILLER, Proc. Wash. Acad. Sci., vol. 2, p. 232, August 20, 1900.

Type-locality.—Pulo Siantan, Anamba Islands, South China Sea.

Type-specimen.—In United States National Museum, Cat. No. 101710, skin and skull of adult female collected on Pulo Siantan, August 24, 1899, by Dr. W. L. Abbott; in good condition.

Geographic distribution.—Known only from Pulo Siantan, Anamba Islands. See No. 33 on map on page 75.

Diagnosis.—A member of the *splendidula* group, having the general appearance above of a bright reddish *T. glis ferruginea*, inner half of the caudal hairs viewed from below, ochraceous or tawny ochraceous; mammæ, 2–2 = 4.

Color.—Upper parts of body a grizzle of a color between ferruginous and chestnut, and blackish, brightest anteriorly; head a grizzle of ochraceous and blackish; outer sides of legs similar in color to adjacent parts of body; upper side of tail like back; outer edge of underside of tail similar to its upper surface, basal half or more of the long caudal hairs ochraceous or tawny ochraceous; underparts, buff to olive buff, with dark bases of the hairs showing through.

Skull and teeth.—Intermediate in size between those of *T. splendidula* and *T. glis ferruginea*, and rather more like the latter in form; incisive foramina relatively short and wide. (Plate 10, fig. 10.)

Measurements.—Type: Head and body, 178 mm.; tail, 152; hind foot, 43; condylo-basal length, 48; zygomatic width, 25; width of brain case, 19; maxillary tooth row, 19. See table, page 93.

Specimen examined.—One, the type.

TUPAIA RIABUS, new species.

Type-locality.—Pulo Riabu, Anamba Islands.

Type-specimen.—In United States National Museum, Cat. No. 104881, skin and skull of adult female collected on Pulo Riabu, Anamba Islands, South China Sea, August 23, 1900, by Dr. W. L. Abbott, in good condition.

Geographic distribution.—Known only from Pulo Riabu. See No. 34 on map on page 75.

Diagnosis.—A member of the *splendidula* group, intermediate in characters between *Tupaia lucida* of Pulo Laut, Natuna Islands, and *T. chrysomalla* of Pulo Siantan, Anamba Islands; mammæ, 2–2 = 4.

Color.—Upper parts of body and back of head ferruginous or orange rufous, irregularly lined with blackish; on head anteriorly and above shoulder stripe, the ferruginous colors replaced by ochraceous tints; outer side of legs similar to adjacent parts of body; tail above similar to upper parts of body, but blackish element practically wanting in distal three-quarters; long hairs of underside of

tail almost clear orange rufous; underparts, including inner side of legs, and short appressed hairs on underside of tail, ochraceous buff; feet blackish brown finely lined with ochraceous.

Skull and teeth.—Not essentially different from those of *Tupaia lucida* or *T. splendidula*, but distinctly smaller, especially the teeth, as compared with *T. chrysomalla*.

Measurements.—Type: Head and body, 176 mm.; tail, 146; hind foot, 43; condylo-basal length, 45.5; zygomatic width, 23.5; width of brain case, 19; maxillary tooth row, 18. See table, page 93.

Remarks.—*Tupaia riabus* is a very different treeshrew from its geographic neighbors, and externally and cranially appears to be more closely related to *T. lucida* of the Natunas. It is interesting to note that Pulos Laut and Riabu are about the same general area. *Tupaia riabus* was collected on a second visit to the Anamba Islands by Doctor Abbott in 1900, and hence was not included in Mr. Miller's account of the mammals of the Anamba and other islands published in the same year.[1]

Specimens examined.—Two, the type, and a young individual also from Pulo Riabu.

TUPAIA ANAMBÆ, new species.

Type-locality.—Pulo Jimaja, Anamba Islands.

Type-specimen.—In United States National Museum, Cat. No. 101743, skin and skull of adult male collected on Pulo Jimaja, Anamba Islands, September 23, 1899, by Dr. W. L. Abbott.

Diagnosis.—Very closely allied to *Tupaia chrysomalla* of Pulo Siantan, but distinguished by a generally less reddish coloration of head and body; mammæ probably 2–2 = 4.

Geographic distribution.—Known only from Pulo Jimaja, Anamba Islands. See No. 35 on map on page 75.

Color.—The color of *Tupaia anambæ* is so like that of *T. chrysomalla* that no detailed description is necessary. The ferruginous or chestnut-like color in *T. chrysomalla* is much lighter in color and replaced by a color something like tawny ochraceous; the whole lower back, rump, and thighs are lighter; the underparts are lighter more buffy and less ochraceous than in *T. chrysomalla*, but the tawny ochraceous color of the underside of the tail is of a darker shade in *T. anambæ*. Some of the difference in color may be due to difference in pelage, as the type of *chrysomalla* appears to be in an old pelage, while the type of *T. anambæ* is mostly in a fresh pelage. There is one skin of *T. anambæ*, Cat. No. 101741, which has just begun to change pelage, and while not appearing so distinct from *T. chrysomalla* as the type skin of *T. anambæ*, it has distinct though slight color differences and

[1] Mammals collected by Dr. W. L. Abbott on islands in the South China Sea, Proc. Wash. Acad. Sci., vol. 2, pp. 203–246, August 20, 1900.

is quite as good a form as many of the recognized insular forms of *T. glis*.

Skull and teeth.—The skull and teeth of *Tupaia anambæ* do not show any differences from those of *T. chrysomalla*.

Measurements—Type: Head and body, 178 mm.; tail, 152; hind foot, 47.5; condylo-basal length, 24.5; zygomatic width, 18.5; maxillary tooth row, 18.5. See also table, page 93.

Remarks.—The treeshrews of the Anamba Islands fall into two groups, the species on Pulo Riabu closely related to *Tupaia lucida* of the Natuna Islands and the form on Pulo Jimaja and Pulo Siantan, closely related to one another and not being closely allied to any other form. All three of the islands are separated by water of about the same depth, and approximately the same depth of water is found between them and Borneo on one side and the Malay Peninsula on the other. In many respects *Tupaia chrysomalla* and *anambæ* show many resemblances to *T. glis ferruginea* in color of the head and body, but their smaller size and color of the tail serve to distinguish them.

Specimens examined.—Three, all from Pulo Jimaja.

TUPAIA CASTANEA Miller.

1903. *Tupaia castanea* MILLER, Smiths. Misc. Coll., vol. 45, p. 54, November 6, 1903.

Type-locality.—Pulo Bintang, Rhio Archipelago, East Indies.

Type-specimen.—In United States National Museum, Cat. No. 115608, skin and skull of adult female collected on Pulo Bintang, August 11, 1902, by Dr. W. L. Abbott, original number, 1872; in good condition.

Geographic distribution.—Known only from Pulo Bintang. See No. 17 on map on page 75.

Diagnosis.—Related to *Tupaia splendidula*, but not so dark in color, and in size equalling *T. glis ferruginea;* mammæ, 2–2 = 4.

Color.—General color effect of upper parts of back of head, neck, and body and outer side of legs something between hazel and chestnut, but rather darker and brighter; on closer examination this effect seen to be produced by an indistinct and coarse grizzling of black and a color something like a rich dark ferruginous; front of head a fine grizzle of blackish and ochraceous or tawny ochraceous; tail above similar to the back in places, especially near base or else a color between orange rufous and cinnamon rufous; underside of tail between orange and cinnamon rufous; general color of under parts, including innerside of legs, between ochraceous and tawny ochraceous, with darker bases of hairs showing through in places, especially on the inner side of legs; hands and feet a fine grizzle of blackish and ochraceous; shoulder stripe moderately distinct, light tawny ochraceous or ochraceous rufous.

Skull and teeth.—These are of the same general form as they are in *Tupaia splendidula*, but larger throughout. The incisive foramina are rather large and less slit-like and the bullæ somewhat larger than in the case of *T. glis ferruginea*. (Plate 10, fig. 9.)

Measurements.—Type: Head and body, 200 mm.; tail, 145; hind foot, 46; condylo-basal length, 49; zygomatic width, 25.5; width of brain case, 19.5; maxillary tooth row, 19. The measurements of the type are not materially departed from in a series of eight individuals, for measurements of which see table, page 93.

Remarks.—*Tupaia castanea* is a very distinct form; from *T. splendidula* it is at once distinguished by its larger size, equaling *T. glis ferruginea*, and from *T. glis ferruginea* by its *splendidula* style of coloring. Schneider's[1] record from the Indragiri, Sumatra was perfectly correct so far as the group is concerned, but his specimens are now identified as *Tupaia siaca*.

Specimens examined.—Eight, all from Pulo Bintang.

TUPAIA SIACA Lyon.

1908. *Tupaia siaca* LYON, Proc. U. S. Nat. Mus., vol. 34, p. 661, September 14, 1908.

Type-locality.—Little Siak River, lowlands of eastern Sumatra.

Type-specimen.—In United States National Museum, Cat. No. 144205, skin and skull of adult female collected along the Little Siak River, Sumatra, November 4, 1906, by Dr. W. L. Abbott; original number, 4856; in good condition.

Geographic distribution.—Known only from the Little Siak and Indragiri River regions, probably occurring in the intervening region, and for a moderate distance beyond, on either side. See No. 8 on map on page 75.

Diagnosis.—Very similar to *Tupaia castanea*, but underparts and inner side of legs buff to ochraceous buff, instead of ochraceous to ochraceous rufous; hairs of tail, seen above more distinctly annulated, but seen below without annulations except beyond middle of hairs; color of upper parts not quite so dark and rich as in *T. castanea*, especially in the region of the neck and shoulders, which are lighter and brighter, and more grizzled than in *T. castanea*; mammæ, 2–2 = 4.

Color.—*Tupaia siaca* is in general very similar in color to *T. castanea*, and the differences have been sufficiently pointed out under the diagnosis, so that no detailed description is necessary.

Skull and teeth.—The skull and teeth of *Tupaia siaca* are essentially like those of *T. castanea*. (Plate 10, fig. 8.)

Measurements.—Type: Head and body, 205 mm.; tail, 175; hind foot, 47; condylo-basal length, 50.5; zygomatic width, 25.5; width of brain case, 19.5; maxillary tooth row, 19. The tail of the type is from 10 to 15 mm. longer than is the case with most of the adult specimens

[1] Zool. Jahrb., vol. 23, p. 87, 1905.

examined, otherwise the measurements of the type represent the average for the species. For individual measurements, see table, page 93.

Remarks.—*Tupaia siaca* and *T. castanea* form a very interesting and at same time puzzling group of treeshrews. Both are very closely related to one another and geographically they are widely separated. Pulo Bintang is about as far removed from Sumatra as any island of the Rhio Archipelago, and no Tupaias of this group are found on the intervening islands. In fact treeshrews are poorly represented on the islands of the Rhio-Linga Archipelago. On Batam, the next island to Bintang, occurs a treeshrew that is separable with difficulty from *T. glis ferruginea*, and on Sinkep, an island close to Sumatra, is another member of the *glis* group. Other treeshrews in the Archipelago are without interest in this connection. *Tupaia castanea* and *siaca* as judged by color, are certainly related to *T. splendidula* of Borneo. In point of size they equal *T. glis ferruginea*, and I have been unable to find any definite constant character in the skulls or teeth, to separate them as a group from *T. glis ferruginea*. The question immediately arises what is their relation to *T. g. ferruginea*. The two forms, *T. castanea* and *siaca* may be geographic representatives of that widely spread species. So far as we know *T. g. ferruginea* does not occur at the same localities with them. Only on Borneo do we find *T. splendidula* occurring with what is evidently a representative of *T. glis ferruginea*, that is *T. longipes*. Those two forms are very different externally and cranially. On the Anamba Islands are found Tupaias which in point of size and lack of annulations on the tail are certainly members of the *splendidula* group, but some of them in general body color resemble *T. glis ferruginea* very closely. The available material indicates that typically the *glis ferruginea* and *splendidula* groups are very distinct, but forms of each occur strongly suggesting the other group. The relation of *T. demissa* to the *splendidula* group is puzzling. It occurs on Sumatra just to the northeast of the range of *T. siaca*. In the general color of its upper parts it is very similar to *T. siaca* and *T. castanea*. It has more grizzling along the sides than has the members of the *splendidula* group and less on the thigh than usual in *T. g. ferruginea*. The underparts are more like those of *T. g. ferruginea*, so is the skull. The hairs of the underside of the tail are certainly lacking in the annulations even more than the hairs of *T. siaca*. The species *demissa* could with almost as much propriety be considered an abnormal color form of *T. siaca* as it is so considered of *T. g. ferruginea* Schneider's specimens recorded[1] as *Tupaia custanea* from the Indragiri region Sumatra are *T. siaca*.

Specimen examined.—Eight from the Siak region and two from the Indragiri.

[1] Zool. Jahrb., vol. 23, 1905, p. 87.

Measurements of Tupaia siaca, castanea, chrysomalla, riabus, and anambæ.

Name.	Locality.	Number.	Sex.	Molar teeth worn.	Head and body.	Tail.	Hind foot.	Condylo-basal length.	Zygomatic width.	Width of brain case.	Maxillary tooth row.	Number of mammæ.
					mm	*mm*	*mm*	*mm*	*mm*	*mm*	*mm.*	
T. siaca.....	Sumatra, Little Siak River.	144201....	Male...	Moderately	210	156	48	49	26	19.5	19	....
Do.....	.....do.....	144205 [1]...	Female	Much.....	205	175	47	50.5	25.5	19.5	19	2-2
Do.....	.....do.....	144209....	Male...	Moderately	198	165	49	50	26	19.5	19.5	....
Do.....	.....do.....	144206....	Female	None [2].....	172	148	45	43	23.5	20	18±	....
Do.....	.....do.....	144207....	...do...	...do.[3].....	174	148	43	43	23.5	20	18	....
Do.....	.....do.....	144208....	Male...	...do.[4].....	159	156	48	41	22	19.5	.....	....
Do.....	.....do.....	144210....	...do...	...do.[5].....	190	170	46	46.5	23	19	18.5	....
Do.....	Sumatra, Siak River at Buwatan River.	144306....	Female	...do.[3].....	160	150	45	....	....	....	17	2-2
Do.....	Sumatra, Indragiri	174610 [6]...	Male...	Much.....	200	170	48	47	26±	19.5	19	....
Do.....	.....do.....	4.6.9.2....	...do...	...do.....	190	152	49	51	27.5	21	20	....
T. castanea...	Pulo Bintang, Rhio Archipelago.	115607	...do...	.....	210	150	46	49	....	....	.....	....
Do.....	.....do.....	115608 [1]...	Female	Much.....	200	145	46	49	25.5	19.5	19	2-2
Do.....	.....do.....	9.4.1.99..	Male...	None [7].....	178	137	45	47	....	20	18	....
Do.....	.....do.....	9.4.1.100.	...do...	...do.[3].....	206	149	43	49.5	23	19	19	....
Do.....	.....do.....	9.4.1.101.	Female	Moderately	207	151	45	56.5	26.5	20	916.5	2-2
Do.....	.....do.....	9.4.1.102.	Male...	...do.....	184	162	48	50	26	19	20	....
Do.....	.....do.....	9.4.1.103.	...do...	Slightly....	186	153	46	49.5	27	20	19	....
Do.....	.....do.....	9.4.1.104.	Female	...do.....	177	150	45	50	....	20	19.5	2-2
T. chrysomalla	Anamba Islands, Siantan.	101710 [1]...	...do...	Moderately	178	152	43	48	25	19	19	2-2?
T. riabus.....	Anamba Islands, Riabu.	104881 [1]...	...do...	Slightly....	178	146	43	45.5	23.5	19	18	2-2
Do.....	.....do.....	104880....	Male...	None [10].....	165	140	42	40	21.5	19	.....	....
T. anambæ...	Anamba Islands, Jimaja.	101741	...do...	Moderately	171	140	42	46.5	24.5	19	18.5	....
Do.....	.....do.....	101743 [1]...	...do...	...do.....	178	152	43	47.5	24.5	18.5	18.5	....
Do.....	.....do.....	101742....	Female	...do.....	191	114	40	45.5	25±	19	17.5	2-2?

[1] Type.
[2] m^2 nearly level with m^1.
[3] m^3 just level with alveolus.
[4] m^2 just level with alveolus.
[5] Permanent pm^3 and pm^4 not in place.
[6] Preserved in alcohol.
[7] m^3 just appearing.
[8] di^1 still in place.
[9] Canines lacking (upper).
[10] m^2 last tooth in place.

TUPAIA MONTANA Thomas.

(Synonymy, type-specimens, etc., under the subspecies.)

Geographic distribution.—Mountains of northern Borneo. See Nos. 25 and 26 on map on page 75.

Diagnosis.—A medium-sized treeshrew, slightly smaller than *Tupaia glis ferruginea*, with rather long soft fur, general color Prout's brown or burnt umber, with or without a dark patch or stripe on back; tail not dissimilar in color from sides of body; skull in general similar to that of *T. glis ferruginea*, smaller and with a relatively shorter brain case, and rostrum strongly compressed from above downward; mammæ, 2-2=4.

Color.—Upper parts and sides of neck and body and outer side of legs a grizzle of blackish and a color between tawny olive and walnut brown, the black being slightly less evident than the other color; the tawny olive tint predominating anteriorly and the walnut brown posteriorly; back sometimes marked by a large black patch, beginning

narrowly between the shoulders, 2 to 3 mm. wide and widening over the lower back and hips to 25 or 30 mm.; head a fine grizzle of black and raw sienna, the latter predominating on the sides, the blackish on the crown; underparts an ill-defined grizzle of dark tawny ochraceous and slate, the tawny ochraceous lighter and more yellowish anteriorly; tail above, similar to adjacent parts of body, but grizzle coarser; tail, below, with short appessed hairs, in median line, a fine grizzle of blackish and ochraceous, the darker color predominating, the longer hairs, tawny ochraceous for their basal third, and a coarse grizzled mixture of this same color and dark brownish distally; feet and hands dark brownish with a very slight admixture of the light color of the adjoining parts of body; shoulder stripe practically obsolete.

Skull and teeth.—The skull of *Tupaia montana* is of moderate size slightly smaller than that of *T. glis ferruginea*, with relatively much wider brain case and more spreading zygomata; the rostrum has a more abrupt origin from rest of skull and is much compressed from above downward, especially the basal portion just posterior to the nasals. The first and second upper molars of *T. montana* are more quadrate in outline than they are in *T. glis ferruginea* and the hypocone of m^1 is better developed. (Plate 9, fig. 2.)

Subspecies.—There are two subspecies of *Tupaia montana*, the typical form *T. montana montana* from Mount Dulit and a form from Mount Kina Balu, described below as new. Aside from some slight color and cranial differences the two forms are chiefly distinguished by the presence in the Dulit specimens of a more or less well-defined dorsal patch and its absence in the animal from Mount Kina Balu.

Remarks.—*Tupaia montana* is a very distinct species and easily distinguished by external and cranial characters from other members of the genus. It does not appear to have any close resemblance to other members of the genus, except the later described *Tupaia carimatæ*. The presence or absence of a black patch on specimens does not appear to be attributable to age, sex, or season. Most specimens from Mount Dulit show it plainly, while on Kina Balu specimens it is but barely indicated.

TUPAIA MONTANA MONTANA Thomas.

1892. *Tupaia montana* THOMAS, Ann. Mag. Nat. Hist., ser. 6, vol. 9, p. 252, March, 1892.

1892. *Tupaia montana*, THOMAS, Proc. Zool. Soc. London, p. 223, 1892.

Type-locality.—Five thousand feet on Mount Dulit, Sarawak, Borneo.

Type-specimen.—In British Museum, Reg. No. 92.2.7.5, skin and skull of adult male collected October 14, 1891, at 5,000 feet on Mount Dulit, Borneo; skin in good condition; skull with part of occipital region cut away.

Geographic distribution.—Mount Dulit and probably neighboring mountains in Sarawak, Borneo. See No. 25 on map on page 75.

Diagnosis.—Distinguished by the greater frequency of the black back patch, heavier rostrum, slightly larger and darker feet, and facial portion of skull apparently larger and longer. (Plate 9, fig. 2.)

Measurements.—Type: Head and body (dried skin), 215 mm.; tail (dried skin), 140; hind foot, 45; condylobasal length, 47±; zygomatic width, 26.5; width of brain case, 19; maxillary tooth row, 18.5. For individual measurements see table, page 96.

Remarks.—A specimen with a well-defined dorsal stripe can certainly be identified with this subspecies, but if the stripe is practically obsolete as in Reg. No. 92.2.7.6, one is uncertain whether to place the specimen in this subspecies or the next. The Dulit subspecies appears to average larger than that from Kina Balu.

Specimens examined.—Twelve from Mount Dulit.

TUPAIA MONTANA BALUENSIS, new subspecies.

Type-locality.—Mount Kina Balu, northeastern Borneo.

Type-specimen.—In British Museum, Reg. No. 95.10.4.20, skin and skull of adult collected at 3,000 feet on Mount Kina Balu, northeastern Borneo, March, 1887, by J. Whitehead; skin in fair condition; skull with about a third of the right side of brain case wanting.

Geographic distribution.—Known only from Mount Kina Balu, Borneo. See No. 26 on map on page 75.

Diagnosis.—Differs from *Tupaia montana montana* in the absence of the distinct black back patch, smaller size; rostrum and whole facial portion of skull smaller and shorter; hind feet not quite so dark as in the typical form.

Measurements.—Type: Head and body (dried skin), 190 mm.; tail (dried skin), 90; hind foot, 39; condylobasal length, 43±; maxillary tooth row, 17. For measurements of two other individuals, which differ considerably from this type in having the tail 125 mm. long, see table, page 96.

Remarks.—In certain lights there is a suggestion of the broad dorsal stripe, which is almost as evident as in those Dulit specimens, where the stripe is practically lacking. Mr. Thomas has this note on the label of the type: "Of 15–20 specimens from Kina Balu (A. Everett) carefully compared, and some quite old, with worn teeth, not one had any trace of a dorsal line, not even as much as this." The absence of the dorsal stripe would appear to be very constant in this subspecies, much more so than the presence of the stripe is in *T. montana montana.* The Kina Balu specimens were identified by Mr. Thomas in 1889[1] as *Tupaia ferruginea.*

Specimens examined.—Three from Mount Kina Balu.

[1] Proc. Zool. Soc. London, 1889, p. 229.

Measurements of Tupaia montana.

Name.	Locality.	Number.	Sex.	Molar teeth worn.	Head and body.	Tail.	Hind foot.	Condylo-basal length.	Zygomatic width.	Width of brain case.	Maxillary tooth row.	Number of mammæ.
					mm	*mm*	*mm*	*mm*	*mm*	*mm*	*mm*	
T. montana montana.	Borneo, Mount Dulit.	84507.....	Male...	Moderately.	180±	150±	42	45.5	25.5	19	17.5	....
Do.....	Mount Dulit, 4,000 feet.	92.9.4.2....	...do...	Slightly....	220±	165±	43	44±	24.5	19	17.5	....
Do.....	Mount Dulit, 5,000 feet.	92.2.7.5[1]...	...do...	Moderately.	215±	140±	45	47±	26.5	19	18.5	....
Do.....	Mount Dulit, 2,000 feet.	90.12.9.7...	...do...	.....do.....	220±	160±	43	....	....	....	18	....
Do.....	Mount Dulit, 3,000 feet.	99.12.9.9...	Female.	.....do.....	220±	160±	42	46±	....	19	18	2-2
Do.....	Mount Dulit, 4,000 feet.	92.2.7.7....	...do...	([2]).....	215±	130±	43	....	....	....	....	2-2
Do.....	Mount Dulit, 2,000 feet.	99.12.9.8...	Male...	([2]).....	205±	160±	41	....	....	....	....	....
Do.....	Mount Dulit, 3,000 feet.	92.2.7.6....	...do...	None[3].....	205±	150±	41	44±	24	19	17.5	....
Do.....	Mount Poch, 4,000 feet.	93.4.1.3....	.....	.....do.[4]....	195±	130±	39	....	....	....	16.5	....
Do.....	Sarawak.....	93.4.1.38[5]..	Male...	.....	160	150	40	....	....	....	....	....
Do.....	Mount Dulit.....	92.6.1.25[5]...	Female.	.....	160	145	41	....	....	....	....	2-2
Do.....	Mount Dulit, 5,000 feet.	2230 Paris...	...do...	.....	190±	140±	38±	....	....	....	....	....
T. montana baluensis.	Mount Kina Balu, 8,000 feet.	95.10.4.21...	...do...	Slightly....	200±	125±	39	42±	25.5	19.5	17	....
Do.....	.....do.....	94.7.2.7....	.....	None[6].....	165±	125±	39	....	....	....	....	....
Do.....	Mount Kina Balu, 3,000 feet.	95.10.4.20[1].	.....	Moderately.	190±	90±	39	43±	....	....	17	....

[1] Type.
[2] Skull in skin.
[3] *di*[1] and *di*[2] still in place.
[4] *pm*[4] just appearing.
[5] Preserved in alcohol.
[6] *m*[1] last tooth in place.

TUPAIA PICTA Thomas.

1892. *Tupaia picta* THOMAS, Ann. Mag. Nat. Hist., ser. 6, vol. 9, p. 251, March, 1892.

Type-locality.—Apoh, Baram, northern Borneo.

Type-specimen.—In British Museum, Reg. No. 92.2.8.1, skin and skull of adult, sex unknown, collected by A. Everett, at Apoh,[1] Baram, Borneo, September, 1891; skin in good condition; skull with supra-occipital missing.

Geographic distribution.—Baram region, Sarawak, northern Borneo. There are no definite records of its occurring elsewhere. I have seen one specimen labeled "Sarawak," but this probably refers to the state and not the town, and another labeled "Balingean, Sarawak." I have been unable to find a town or other place of this name on any of the numerous maps of Borneo which I have examined. See No. 22 on map on page 75.

[1] The label of the type-specimen is marked "Baram, N. Borneo, Apoh." Apoh appears to be applied to a group of low (600 feet) hills south of Mount Mulu; the name is also applied to a river in the same neighborhood, a tributary of the Baram River. In his Mammals of Borneo, 1893, page 32, Mr. C. Hose says that the type of the species came from the Ridan River, a small tributary of the Baram, just below Claudetown, a distance of about 25 miles from the Apoh River.

Diagnosis.—A very distinct species of *Tupaia* at once characterized by a narrow black dorsal line, and distichously bushy rufescent tail; mammæ, 2–2 = 4.

Color.—Type: Upper parts of head, neck, and body anterior to rump a grizzle of blackish and ochraceous, with a very distinct narrow dorsal blackish line extending from region of neck to rump, the grizzling very coarse in the dorsal region; toward rump and base of tail, ochraceous color gradually replaced by ferruginous; tail a mixture of ferruginous and blackish, the two colors about equally mixed on basal half of tail above, the ferruginous predominating distally and below, except on outer edge, which is like upper surface; underparts including inner side of legs, dull buff to ochraceous buff; outer side of legs similar to adjacent parts of body, and feet similar in color to outer side of legs; shoulder stripe, well marked, dull ochraceous. The specimens from Mount Dulit, Mount Kulalong, and Balingean are slightly darker than the others, with the dorsal stripe less distinct; underparts are of a distinctly darker ochraceous about the neck and chest, and a grizzle of ochraceous or tawny ochraceous and blackish on rest of underparts and inner side of legs; the feet are blackish brown, perhaps due to a preservative, as they have an unnatural look. Two adults from Mount Mulu have the yellowish grizzling of the back, very coarse and conspicuous; the feet are of the usual yellowish brown color.

Skull and teeth.—The skull has about the same general build as that of *T. montana*, but lacks the above downward compression at base of rostrum, and approaches the skull of *T. glis ferruginea* in size; the bullæ are relatively larger than they are in *T. montana* or *T. g. ferruginea*. The brain case is relatively wide like that of *T. montana*. The zygomatic perforation is slightly smaller than it is in *T. glis ferruginea* The upper molar teeth are not so quadrate in outline as they are in *T. montana* and show no essential differences from the teeth of *T. glis ferruginea*. (Plate 9, fig. 3.)

Measurements.—Type: Head and body, 195 mm. (from dried skin); tail, 155 (from dried skin); hind foot, 45; condylobasal length, 47.5; zygomatic width, 26; width of brain case, 19.5; maxillary toothrow, 18.5. Measurements of the series do not depart materially from those of the type. See table, page 98.

Remarks.—*Tupaia picta* is a very distinct species and needs no comparison with any other. It is quite in a class by itself and appears to have no near relatives. The superficial external resemblance to the long-snouted treeshrews, *Tana tana* is very interesting; both have the same distichously bushy ferruginous tails, both have a narrow black dorsal stripe, bordered on either side by lighter grizzled areas. The dorsal stripe, however, is very short in *Tana* and a careful

examination of the markings in *Tana tana* and *Tupaia picta* shows that the resemblance is more superficial than real. The skull of *Tupaia picta* is a typical *Tupaia* skull, and the arrangement of the naked area on the end of the nose and the small size of the claws all show it to be a true *Tupaia*. The distribution of *Tupaia picta* seems to be quite restricted. Judging by the number of specimens examined it appears to be a fairly common animal in the Baram District, and I doubt if it occurs in southern Borneo, as Doctor Abbott would probably have encountered it sometime during his four expeditions there. In his Mammals of Borneo [1] Hose says of it: "This tree-shrew is more common in the low country than on the mountains; it is usually found in the dense forest and is particularly active in its movement."

Specimens examined.—Fourteen, all apparently from the Baram District, Borneo.

Measurements of Tupaia picta.

Locality.	Number.	Sex.	Molar teeth worn.	Head and body.	Tail.	Hind foot.	Condylo-basal length.	Zygomatic width.	Width of brain case.	Maxillary tooth row.	Number of mammæ.
				mm.	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	
Borneo, Baram	84506	Male	Moderately	.....	.....	46	48	27	20	18	....
Borneo, Mount Batu Sang.	669/4, Geneva.	Female	None [1]	190±	165±	43	48±	24	19	15	....
Borneo, Mount Dulit, 2,000 feet.	92. 9. 4. 1	Male	[2]	220±	155±	44	.....	.....	.....	.....	....
Balingean, Sarawak	5. 3. 1. 5	Female	Moderately	210±	135±	45	47.5	25.5	19	18	2–2
Mount Kalulong	93. 6. 1. 2	Male	[2]	235±	155±	45	.....	.....	.....	.....	....
Mount Mulu, 1,000 feet	8. 1. 27. 3	...do...	[2]	220±	150±	43	.....	.....	.....	.....	....
Mount Mulu	94. 6. 2. 2	...do...	Moderately	240±	150±	45	48.5	.....	20	19	....
Do	94. 6. 2. 3	...do...	None [3]	195±	140±	43	.....	.....	18.5	17	....
Batu Sang, 3,000 feet	92. 11. 8. 1	...do...	.....do.....	210±	155±	44	.....	.....	19	16.5	....
Baram River	92. 2. 7. 21	...do...	Moderately	215±	155±	45	.....	26	19.5	18	....
Baram, Apoh	92. 2. 8. 14	.....	.....do.....	195±	155±	45	47.5	26	19.5	18.5	....
Baram, Sarawak	0. 8. 4. 8	.....	[2]	205±	160±	43	.....	.....	.....	.....	....
Sarawak	99. 12. 9. 6	Male	Slightly	No skin.		.....	46.5	25	19.5	18	....
Mount Dulit, 2,000 feet	Berlin	...do...	[2]	210±	140±	46	.....	.....	.....	.....	....
(?)	11882, Phila [5].	.....	.....	170±	180±	40±	.....	.....	.....	.....	....

[1] Milk premolars still in place.
[2] Skin with skull inside.
[3] m^3 just appearing.
[4] Type.
[5] Skinned from alcohol and very abnormal in appearance. Academy of Natural Sciences, Philadelphia.

TUPAIA CARIMATÆ Miller.

1906. *Tupaia carimatæ* MILLER, Proc. U. S. Nat. Mus., vol. 31, p. 61, July 23, 1906.

Type-locality.—Telok Edar, Karimata Island, off west coast of Borneo.

Type-specimen.—In United States National Museum, Cat. No. 125123, skin and skull of adult male, collected on Karimata Island, September 2, 1904, by Dr. W. L. Abbott; original number, 3716; in good condition.

[1] Page 32, 1893.

Geographic distribution.—Known only from Karimata Island, but probably occurring on other islands of the same group. See No. 36 on map on page 75.

Diagnosis.—A very distinct species intermediate in general characteristics between *Tupaia splendidula* and *T. montana*, slightly smaller than either, without a black dorsal area, basal portion of hairs of underside of tail, almost without annulations, underparts not distinctly grizzled.

Color.—Type: Upper parts of head, neck, body, outer side of legs and tail a fine distinct grizzle of ochraceous and blackish, the two colors about equally mixed except on dorsal area posterior to shoulders where the black is in excess and suggests the condition found in *Tupaia montana baluensis;* underparts, including inner side of legs, varying from buff to ochraceous buff with dark bases of hairs showing through in places, but not finely grizzled as in *T. montana;* underside of tail ochraceous, distinctly grizzled with blackish along margins, and along the area of short appressed hairs; shoulder stripe, ochraceous, well developed.

Skull and teeth.—Skull slightly smaller than in either *Tupaia montana* or *T. splendidula*, relatively wide, zygomata spreading, braincase inflated, rostrum shortened. The teeth are essentially like those of *T. montana*, but first and second upper molars not quite so quadrate. As a whole the skull seems to have more affinities with that of *Tupaia montana* than with that of *T. splendidula.* (Plate 10, fig. 6.)

Measurements.—Type: Head and body, 176 mm.; tail, 147; hind foot 40; condylobasal length, 42.5; zygomatic width, 24; width of braincase, 18; maxillary toothrow, 16. For individual measurements. see table, page 100, none of which differ essentially from those of the type.

Remarks.—*Tupaia carimatæ* is a very distinct species and would scarcely be confused with any other form. It appears to possess more characteristics of *T. splendidula* than it does of any other species, namely, moderately well developed shoulder stripe, generally ochraceous underparts, without fine distinct grizzling, and basal portion of hairs of tail on underside practically clear ochraceous. Its *montana* characteristics are its generally finely grizzled upper parts, slight tendency to a dark dorsal area, and skull as a whole approaching that of *T. montana* more than that of *T. splendidula.* On geographic grounds it seems most likely that *Tupaia carimatæ* is an insular form of the Bornean *T. splendidula.* The mammalian fauna of Karimata has apparently been derived from forms similar to those occurring in southern Borneo,[1] a region where we know *T. splendidula* certainly occurs.

Specimens examined.—Seven, all from Karimata Island.

[1] See Lyon, Proc. U. S. Nat. Mus., vol. 40, p. 81, April 25, 1911, remarks on squirrels of the *prevostii* group.

Measurements of Tupaia carimatæ.

Locality.	Number.	Sex.	Molar teeth worn.	Head and body.	Tail.	Hind foot.	Condylo-basal length.	Zygomatic width.	Width of brain case.	Maxillary tooth row.	Number of mammæ.
				mm	*mm*	*mm*	*mm*	*mm*	*mm*	*mm*	
Karimata Island, Telok Edar.	125120...	Female..	Moderately .	175	145	40	43.5	23.5	18	13.5	2–2
Do	125121...	...do.....	.....do.....	175	145	40	44	23	18	17	2–2
Do	125122...	...do.....	Slightly.....	.....	.....	39	.....	.....	....	16.5	2–2
Do	125123 [1]..	Male....	Moderately .	176	147	40	42.5	24	18	16	....
Karimata Island, Telok Pai.	125096...	...do.....	.....do.....	170	150	40	43	24.5	18	16.5	....
Do	125097 ..	Female..	None [2].....	165	140	39	.....	22±	....	15	....
Karimata Island.....	153860...	Male....	Slightly.....	165	145	40	.....	23±	....	16	....

[1] Type.

[2] Permanent pm^3 and pm^4 not in place.

TUPAIA NICOBARICA (Zelebor).

(Synonymy, type-specimens, etc., under the subspecies.)

Geographic distribution.—Nicobar Islands, apparently confined to the closely adjacent islands of Great and Little Nicobar.[1] If it occurs on other islands of the group it is probable that the careful collecting of Dr. W. L. Abbott, and Mr. C. B. Kloss in 1901 would have revealed it, as judging by the large number of individuals secured on Great and Little Nicobar it can not be a particularly hard animal to see and secure.

Diagnosis.—One of the most distinct of all the species of *Tupaia*, in general size equaling *T. glis ferruginea*, but tail long and slender, greatly exceeding head and body in length; general color a grizzled yellowish brown, with a distinct blackish area over the middle and lower back, the black extending on to base of tail, but not on thighs or sides; mammæ, 1–1 = 2; claws on both fore and hind feet, half again as large as the claws of *T. glis ferruginea* strongly compressed laterally and very sharp; skull large and angular; central upper incisors strongly developed, greatly exceeding in size the lateral pair.

Color.—Sides of head, neck, and body, outer side of legs, and feet, and region of back over shoulders, and top of nose with the general color effect of wood brown, produced for the most part by a grizzle of tawny olive and blackish brown, entire underparts and inner side of legs generally similar, but often becoming quite light and rather buffy anteriorly; posterior two thirds of back including rump and base of tail, but not extending on thighs or very far down on sides, dark blackish brown; top of head, light blackish brown, the same color spreading down to behind ears and then posteriorly, as an

[1] See Miller, Proc. U. S. Nat. Mus., vol. 24, p. 792, May 29, 1902.

indistinct lateral stripe on either side to meet the dark blackish-brown area of the back, in many specimens, an indistinct median stripe extending from the dark area on top of head to the blackish-brown area of the back; tail, in unworn conditions, very similar to seal brown, both above and below except along the center line below where the color is much lighter. In some specimens the little mid-dorsal stripe from head to the dark area of the back is obsolete, and in others it is more conspicuous than the lateral stripes from ears to dark dorsal area, very rarely are the indistinct stripes from ears to back lacking. In worn condition the tail becomes much lighter in color, approaching cinnamon or russet. Also in worn pelages the dark area of the back becomes lighter and duller. (Plate 3, fig. 1.)

Skull and teeth.—Unlike most members of the genus the skull of *Tupaia nicobarica* is quite characteristic and would hardly be confused with the skulls of other species. The skull has about the same general size as that of *Tupaia glis ferruginea*, but appears more solidly built, and more angular with spreading zygomata and with a more abruptly arising rostrum; the palate is better ossified, the fenestra in zygoma less elongate, and more oval, and often much reduced in size; space between the external and internal pterygoid plates greater and bullæ slightly smaller; the impression for muscular attachment at the antero-inferior angle of the zygoma distinctly smaller, and its small size more noticeable in view of the otherwise greater angularity of the skull; the coronoid process of the mandible is heavier and wider. The teeth of *Tupaia nicobarica* are for the most part similar to those of *Tupaia glis ferruginea*, but the central pair of upper incisors greatly exceed the second pair of upper incisors and are very much larger and more recurved than the corresponding teeth of *T. glis ferruginea*; they have about the same relative degree of development that is seen in *Tupaia javanica*. The upper canines are more slender and pointed than they are in *T. glis ferruginea*. In comparison with other members of the genus, except *T. javanica*, the lower canines are greatly developed, approaching the enormous development of the lower canines in the genus *Urogale*. The third incisor in front and the first premolar behind the lower canine are correspondingly diminished in size, and the length of the lower canine exceeds or at least equals twice the length of incisor in front and often more, while in the species previously considered the lower canine is only one and one-half times the length of the incisor in front and often less.

Measurements.—Usual measurements of adults: Head and body, 180–195 mm; tail, 200–225; hind foot, 45–49; condylo-basal length, 47–50; zygomatic width, 27–29; width of brain case, 19–20; maxillary tooth row, 18–19. For individual measurements see tables, pages 104 and 105.

Subspecies.—Two; *Tupaia nicobarica nicobarica*, page 103, and *Tupaia nicobarica surda*, page 104.

Remarks.—As shown above, *Tupaia nicobarica* is a remarkably distinct species and sharply separated from all other members of the genus by its combination of coloration, large size, long tail, large sharp claws, angular skull, large central upper incisors, and large lower canines.

Tupaia nicobarica was probably first observed in 1846 by Captain Lewis,[1] who reported large squirrels as occurring on the Nicobar Islands. As no squirrels were collected or reported by Abbott and Kloss in 1901,[2] the inference is that Lewis's squirrels, like those seen by Captain Cook's party on Pulo Condore,[3] must have been Tupaias. Zelebor mentions this treeshrew as occurring on all the larger islands of the group, but particularly abundant on Great Nicobar; but as no specimens were collected or reported on other islands than Little and Great Nicobar, by Abbott and Kloss, it would seem that Zelebor's statement is too general. Apparently *Tupaia nicobarica* is a rather conspicuous and noisy treeshrew, otherwise it would not have called forth the few comments that have been made regarding it. Zelebor says it cries frequently and prolonged "Dänh–Dänh" when disturbed or pursued. Doctor Abbott remarks of them, "Common in the heavy jungle which covers the island (Little Nicobar); very active and generally in the tree tops." Kloss[4] writes: "They were very common (Little Nicobar); but unlike their representatives in the Malay Peninsula, etc., which are ground animals, we saw them only in trees. Tupais were plentiful (Great Nicobar). These appear to be entirely arboreal in habits and are quite as active as squirrels in running along branches, or climbing about amongst smaller twigs in search of insects. Their cry is a sort of trilling squeak, which is easily confounded with the call of a bird." The rather large, compressed, sharp claws and the long tail also lead one to believe it more arboreal than most of its relatives.

As to the origin of this treeshrew on the Nicobars it is impossible to say. It is so unlike any of the other treeshrews at present known that it seems highly improbable that it can be descended from any of them, should they have been accidentally carried to the islands, or have been brought there by man. On the other hand, if *Tupaia nicobarica* is the survivor of an old wide-ranging species, one would expect to find other mammals surviving with it. As Mr. Miller shows, the mammals of the Nicobars, "with the single exception of *Tupaia nicobarica*, are all types well known to be closely associated with

[1] Journ. Asiat. Soc. Bengal, vol. 15, p. 368.

[2] Proc. U. S. Nat. Mus., vol. 24, pp. 751–795, May 29, 1902.

[3] See account of *Tupaia dissimilis* in the present paper, p. 67.

[4] In the Andamans and Nicobars, 1903, pp. 122, 136.

man throughout the Malayan region." [1] I can not agree with him that any of the existing treeshrews introduced into the Nicobars by man would have had sufficient time to develop into such a striking species as *Tupaia nicobarica*. Its origin and relationship must for the present remain unsolved.

TUPAIA NICOBARICA NICOBARICA (Zelebor).

1861. *Cladobates nicobaricus* FITZINGER, Sitz. Akad. Wiss. Math. Nat. Wien, vol. 42, 1860, p. 392 (*nomen nudum*).

1869. *Cladobates nicobaricus* ZELEBOR, Reise *Novara*, Zool. Theil, vol. 1, p. 17, pl. 1, fig. 1, entire animal natural size in colors; figs. 2 and 3, soles of fore and hind feet; pl. 2, skull, skeleton, and teeth.

1879. *Tupaia nicobarica*, ANDERSON, Zool. Res. West. Yunnan, p. 136, pl. 7, fig. 3, skull.

1902. *Tupaia nicobarica nicobarica*, MILLER, Proc. U. S. Nat. Mus., vol. 24, p. 773, May 29, 1902.

Type-locality.—Great Nicobar, of the Nicobar Islands.

Type-specimens.—According to Fitzinger,[2] these are in the Imperial Zoological Museum at Vienna. I have not seen them. In the original account are mentioned an alcoholic specimen, a skeleton, and four stuffed individuals.

Geographic distribution.—Great Nicobar, of the Nicobar Islands. See No. 40 on map on page 75.

Diagnosis.—Distinguished by having the light areas brighter and more yellowish, and more strongly contrasted with the dark areas than in the case of the form from Little Nicobar Island; mammæ 1–1=2

Color.—With the differences noted in the diagnosis, the color of *Tupaia nicobarica nicobarica* is sufficiently described in the general account of the species.

Skull and teeth.—There are no characters by which these may be distinguished from those of the other subspecies.

Measurements.—Usual measurements of adults: Head and body, 180–195 mm; tail, 200–225; hind foot, 45–50; condylo-basal length, 47–50; zygomatic width, 26–29; width of brain case, 19–20; maxillary tooth row, 18–19. See table, page 104.

Specimens examined.—Twenty-four.

Remarks.—There are a few individuals in the series of specimens of this, the typical subspecies, that cannot be distinguished with certainty from the form *T. n. surda* that follows.

[1] Proc. U. S. Nat. Mus., vol. 24, p. 791, May 29, 1902.

[2] Sitz. Akad. Wiss. Math. Nat. Wien, vol. 60, 1869, pt. 1, p. 279.

Measurements of Tupaia nicobarica nicobarica.

Locality.	Number.	Sex.	Molar teeth worn.	Head and body.	Tail.	Hind foot.	Condylo-basal length.	Zygomatic width.	Width of brain case.	Maxillary tooth row.	Number of mammæ.
				mm.	*mm*	*mm*	*mm.*	*mm.*	*mm.*	*mm.*	
Nicobar Islands; Great Nicobar	111766	Male	Much	180	203	45	46.5	27.5	19	18	....
Do	111767	do	Moderately	195	220	48	51.5	29	20	19	....
Do	111768	do	do	185	190	45	49	28.5	19.5	18.5	....
Do	111769	do	do	180	200	46	47.5	27.5	19.5	18.5	....
Do	111770	do	Slightly	180	210	46	47	27	19	18.5	....
Do	111774	do	do	195	215	49	49.5	27.5	20	19	....
Do	111776	do	None [1]	178	232	47	47	25	19.5	18.5	....
Do	111777	do	Slightly	192	221	46	49	27	19.5	19	....
Do	111780	do	Moderately	191	225	49	49.5	27.5	20	19	....
Do	111764	Female	Slightly [2]	175	210	44	46.5	26.5	20.5	18	....
Do	111765	do	Slightly	190	220	46	49	28	20	19	1-1
Do	111771	do	do	187	223	49	50	27.5	19	19	1-1
Do	111775	do	do	185	225	48	48.5	27.5	20	19	1-1
Do	111778	do	None [3]	180	215	47	49	25.5	19.5	18	....
Do	111779	do	Slightly	187	215	48	49	28	19.5	18.5	1-1
Do	111781	do	Moderately	190	230	49	51	27.5	19	19	1-1
Do	111783 [4]	Male	([5])	220±	230	50	.....	.....	.....	.....	....
Do	111784 [4]	Female	([6])	215±	220	47	.....	.....	.....	.....	1-1
Do	111786 [4]	do	([6])	215±	220	48	.....	.....	.....	.....	1-1
Do	111787 [4]	do	([7])	165±	200	45	.....	.....	.....	.....	....
Do	111782 [9]	(?)	Modcrately	.....	.....	44	49	28	19	19.5	....
Do	6.7.2.1	.....	None [8]	.....	.....	48	47	25	19.5	17.5	....
Do	6.7.2.2	.....	.....	.....	.....	47	.....	.....	.....	.....	....
Do	85.8.1.94	Male	Slightly	175	.....	48	.....	.....	.....	19	....

[1] *pm* [4] in place, *pm* [3] appearing, but *dpm* still in.
[2] *di* [1] still in place, *i* [1] appearing, *i* [2] halfway through.
[3] *di* [1] still in place, *c* [1] halfway through.
[4] Preserved in alcohol.
[5] Adult, genitalia well developed.
[6] Adult.
[7] About two-thirds grown.
[8] *di* [1] and *di* [2], *dpm* [3] still in place.
[9] Skeleton.

TUPAIA NICOBARICA SURDA Miller.

1902. *Tupaia nicobarica surda* MILLER, Proc. U. S. Nat. Mus., vol. 24, p. 774 May 29, 1902.

Type-locality.—Little Nicobar of the Nicobar Islands.

Type-specimen.—In United States National Museum, Cat. No. 111757, skin and skull of adult male, collected on Little Nicobar Island, March 1, 1901, by Dr. W. L. Abbott; original number, 899; in good condition.

Geographic distribution.—Little Nicobar Island. See No. 41 on map on page 75.

Diagnosis.—*Tupaia nicobarica surda* differs only from *T. n. nicobarica* in having the light areas of the pelage less yellow, generally duller, and less contrasted with the dark areas.

Color.—Sides of head, neck, and body, outerside of legs and feet, and region of back over shoulders, wood brown, generally duller or less "yellow" than in *T. n. nicobarica* above; entire underparts and innerside of legs generally similar, but often lighter and more buffy, especially anteriorly; posterior two-thirds of back, including rump

and base of tail, blackish brown, not contrasting with the light area of the pelage so noticeably as in the typical subspecies; top of head light blackish brown, this color spreading down to behind ears, and usually posteriorly as an indistinct lateral stripe, to meet dark area of back; in many specimens an indistinct median streak extending from top of head to dark area of back.

Skull and teeth.—These do not differ from those of *Tupaia nicobarica nicobarica.* (Plate 10, fig. 7.)

Measurements.—Type: Head and body, 190 mm.; tail, 220; hind foot, 48; condylo-basal length, 49.5; zygomatic width, 28.5; width of brain case, 20; maxillary tooth row, 19. The measurements of the type are slightly in excess of the usual measurements. See table below.

Remarks.—*Tupaia nicobarica surda* is not a highly differentiated form, but it is quite as distinct as some of the insular forms of *Tupaia glis* to which binomial names have been given. The present form is a member of such a distinct species group of which there are only two members so closely related geographically, it would seem a matter of convenience to employ trinomial names even though the two forms were more highly differentiated than they are. As noticed in the original description there are a few specimens in each series of the two subspecies which can not be distinguished with certainty one from the other.

Specimens examined.—Sixteen.

Measurements of Tupaia nicobarica surda.

Locality.	Number.	Sex.	Molar teeth worn.	Head and body.	Tail.	Hind foot.	Condylo-basal length.	Zygomatic width.	Width of brain case.	Maxillary tooth row.	Number of mammæ.
				mm.	*mm.*	*mm*	*mm.*	*mm.*	*mm.*	*mm.*	
Nicobar Islands, Little Nicobar.	111749	Male	Moderately	189	215	46	.....	.....	19±	18±	....
Do	111750	do	Slightly	187	220	48	48	28.5	20	19	....
Do	111752	do	do.[1]	190	200	48	46.5	25.5	20	18	....
Do	111753	do	None[2]	180	200	44	47.5	25.8	19.5	18	....
Do	111756	do	do.[2]	175	215	46	48	25	19	19	....
Do	111759	do	do.[3]	185	215	45	48.5	26.5	19.5	19	....
Do	111760	do	Slightly[2]	178	225	47	47	25.5	20	18.5	....
Do	111761	do	Moderately	180	220	47	49.5	28	19	18.5	....
Do	111757[4]	do	Slightly	190	220	48	49.5	28.5	20	19	....
Do	111751	Female	None[5]	170	220	46	49.5	25	21	18	....
Do	111754	do	Moderately	190	225	46	48	27.5	19.5	18.5	1–1
Do	111755	do	do	185	210	45	47.5	27.5	18.5	18.5	1–1
Do	111758	do	Slightly	180	210	45	47.5	27.5	20	18.5	1–1
Do	111762	do	Moderately	190	210	47	47.5	27.5	19.5	18	1–1
Do	111763	do	Much	182	200	47	48.5	28.5	19.5	18.5	1–1
Do	111785[6]	do	(7)	200±	225	47	.....	.....	.....	.....	1–1

[1] di^1, di^2 still in place, c^1 not at full development.
[2] c^1 just appearing, di^1, di^2, and dc still in place.
[3] di^1 still in place, i^1 appearing, di^2 shed, i^2 nearly in place.
[4] Type.
[5] m^3 just appearing.
[6] Preserved in alcohol.
[7] Adult, pregnant, uterus 30 mm. long.

TUPAIA JAVANICA Horsfield.

1821. *Tupaia javanica* HORSFIELD, Zool. Res. Java, No. 3. Pages not numbered. Plate of entire animal and figures of fore foot and teeth on another unnumbered plate. Date on title page of entire work, 1824. (In the next reference below the third part of Horsfield's Researches is referred to. This reference is dated December, 1821.)

1821. *Sorex-Glis Javanica* or *Tupaya Javanica*, GEOFFROY and CUVIER, Hist. Nat. Mamm., vol 3, livr. 35, p. 1 and plate, December, 1821.

1842. *Cladobates javanica*, CUVIER, Hist. Nat. Mamm., vol. 7, Tab. gen. Meth., p. 2, 1842.

1843. *Hylogalea javanica*, SCHLEGEL and MÜLLER, Verh. Nat. Gesch. Nederl. Overz. Bezitt., p. 165, pl. 26, fig. 4; pl. 27, figs. 11 to 16.

1879. *Tupaia javanica*, ANDERSON, Zool. Res. West. Yunnan, p. 134, pl. vii, figs. 14 and 15.

Type-locality.—Java, Province of Blambangan, probably near the present town of Banyu-wangi at extreme eastern end of Java. See Horsfield's Plantae Javanicae Rariores, 1838–1842, map in front, and page v of postcript.

Type-specimens.—In British Museum. This species was based on two specimens collected by Thomas Horsfield in 1806, in extensive forests in the Province of Blambangan, Java. One of these was sent to the Museum of the Honorable East India Co. in 1812. It is now in the British Museum, Reg. No. 79.11.21.574; it is not mounted, is in poor condition; skull immature with the milk incisors still in place, zygomata broken away, as well as occipital bones and anterior third of right half of mandible. The other specimen was brought to England by Horsfield in 1819, and is now in British Museum, No. 52a; it is an old specimen, was formerly mounted, and is in poor condition; parts of the cranium posterior to the tooth rows are broken away; mandible perfect. A third specimen marked "cotype" is in the British Museum, No. 52b, Java, "pres. by E. F. Comp"; neither its skin nor skull are in good condition. I do not consider this specimen a cotype and see no reason why it should be so marked.

Geographic distribution.—Java, western part of Sumatra back from coast, and islandof Nias. See No. 1 on map on page 111.

Diagnosis.—Tail longer than head and body; skull shaped like that of *Tupaia nicobarica*, but much smaller, condylobasal length not exceeding 41 mm.; central upper incisors and lower canines enlarged in the manner of those of *T. nicobarica*; general coloration of upper parts and tail olivaceous finely grizzled, under parts moderately dark and grizzled; hind foot about 38 mm.; mammæ, 2–2=4.

Color.—Upper parts and sides of head, neck, body, tail, outerside of legs and feet, with the general color effect of something between olive and bister, produced by a fine distinct grizzling of blackish and light tawny olive or raw sienna; the two colors about equally mixed, the grizzling on the tail coarser and on the feet finer; underparts of body always rather dark, the bases of the hairs being

extensively slate-color, which shows through usually to a considerable extent; general effect of underparts varying from an almost clear gray, not unlike olive gray slightly tinged with buffy, to an almost uniform ochraceous, with more or less of dark bases of hairs showing through, the ochraceous colors of the underparts more pronounced anteriorly and the gray better developed posteriorly; shoulder stripe conspicuous, buff or cream buff in color.

Skull and teeth.—The skull and teeth of *Tupaia javanica* are almost an exact miniature of those of *Tupaia nicobarica*, but the zygomata are relatively less spreading, the brain case relatively more inflated, the bullæ relatively larger, and the palate less completely ossified. The enlargement of the central upper incisors, and lower canines, and reduction in size of the third lower incisors are in the same relative degree in *Tupaia javanica* as they are in *T. nicobarica*. (Plate 10, fig. 1.)

Measurements.—The available measurements of cotype Reg. No. 79.11.21.574, a specimen not fully adult, the milk incisors still being in place, are: Hind foot, approximately, 36 mm.; width of brain case, 17.5; maxillary tooth row, 14; the other cotype, 52a has the maxillary tooth row 14.5; the specimen is in such poor condition that the other usual measurement can not be taken. Usual measurements of adults: Head and body, 145–155 mm; tail, 160–175; hind foot, 37–39; condylobasal length, 38–41; zygomatic width, 22–23; width of brain case, 17–18; maxillary tooth row, 14–15. For individual measurements see table, pages 108, 109.

Remarks.—*Tupaia javanica* is a very distinct species with no near relatives; its large size, dark underparts, and *nicobarica* shape of skull at once separates it from the other small olivaceously colored members of the genus, while the smaller size and differences in color serve, of course, to distinguish it from *Tupaia nicobaria*, and its smaller size and longer tail to distinguish it from the *chinensis* group. Whether or not it is true *Tupaia javanica* that occurs on Sumatra and Nias it is impossible to say with the available material. The mounted skin in Genoa from Pulo Nias appeared unusually dark, especially the tail, which is quite blackish. I have little doubt that more material will show it to be a distinct geographic form of *Tupaia javanica*.[1] The specimens from Sumatra, Si Rambi, Mount Singalang, and Pajo resemble the Javan specimens, but the material is not sufficient to establish their true status. Apparently *Tupaia javanica* on Sumatra is confined to the higher regions. Although Doctor Abbott has visited many places on the Sumatran coast, he found no examples of it.

Specimens examined.—Java, 58; Sumatra, 12; Nias, 1. Although this material seems abundant, yet an examination of the list of specimens, pages 108, 109, will show most of it is made up of immature individuals, and specimens preserved in alcohol.

[1] Recorded by Modigliani, Ann. Mus. Civ. Stor. Nat. Genoa, ser. 2, vol. 7 (27), p. 239, 1889.

Measurements of Tupaia javanica.

Locality.	Number.	Sex.	Molar teeth worn.	Head and body.	Tail.	Hind foot.	Condylo-basal length.	Zygomatic width.	Width of brain case.	Maxillary tooth row.	Number of mammæ.
				mm.	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	
Java, Mount Salak, 3,500 feet.	154593	Female.	Adult	145	160	37	....	....	....	....	2–2
Java, Mount Salak, 3,000 feet.	154580	Male	....	....	....	36	....	....	....	....	....
Java, Mount Salak, 2,200 feet.	154594	do	None [1]	110	145	36	33	20	17	....	....
Java, Mount Gede, 4,500 feet.	155656	Female.	Slightly	134	170	38	39	21.5	17	15	....
Java, Pelaboean Ratoe	155659	do	None [2]	115	150	36	34	19.5	18	....	....
Java, Mount Salak	154598	Male	Slightly	....	....	....	39.5	22.5	16.5	14.5	....
Java, Buitenzorg	1431 [3]	do	[4]	125±	135	35	....	....	....	....	....
Java, Tanjoug Priok, near Batavia.	121492	do	Moderately	....	....	37	40	22.5	17.5	14.5	....
Do	121491	do	do	....	....	36	39	22	17	14.5	....
Do	121489	(?)	Slightly	....	....	36	38	20	16.5	14	....
Do	121488	Female.	Moderately	....	....	36	40	22	18	14.5	2–2
Do	121490	do	do	....	....	38	41	22±	18	14.5	2–2
Do	121493	do	None [5]	....	....	37	40±	21.5	18	14.5	2–2
Java, Province of Blambangan.	52a [6]	....	Moderately	....	....	....	....	....	....	14.5	....
Do	79.11.21.574 [8]	....	None [7]	....	....	36±	....	....	17.5	14	....
Java	52b	....	do [7]	....	....	37	....	....	....	13.5	....
Java, Prigen (slopes of Ardjoeno Volcano) 1,800 to 2,300 feet, Bangit.	96.10.31 [8]	Female.	....	150	160	39	....	....	....	....	2–2
Java, Tasikmalaja	9.1.5.1116 [8]	do	....	155	160	38	....	....	....	....	2–2
Java, Preanger	9.1.51117 [8]	Male	....	140	160	38	....	....	....	....	....
Java, Buitenzorg	94.7.4.7 [8]	Female.	....	145	155	37	....	....	....	....	2–2
Java, southeast	84.4.24.5 [8]	do	....	140	150	35	....	....	....	....	2–2
Java, Tasikmalaja, Preanger, 1,145 feet.	9.1.5.532	Male	Moderately	155	178	39	41	23	17.5	15	....
Do	9.1.5.533	do	Slightly	(9)	....	....	41	22.5	18	15	....
Do	9.1.5.534	do	None	150	175	38	39.5	22.5	17.5	14.5	....
Do	9.1.5.535	do	do [10]	125	160	37	33.5	18.5	17	....	....
Do	9.1.5.536	do	do [10]	....	....	37	34.5	19.5	17.5	....	....
Do	9.1.5.537	do	Moderately	155	190	38	40.5	23.5	17.5	14.5	....
Do	9.1.5.538	do	Slightly	150	163	37	41	22.5	18	15	....
Do	9.1.5.539	do	Moderately	147	167	38	39.5	21.5	17.5	14.5	....
Do	9.1.5.540	do	None [10]	118	160	37	34	....	18	....	....
Do	9.1.5.541	do	do [7]	148	158	36	38.5	21.5	18.5	14.5	....
Do	9.1.5.542	Female.	do [10]	120	155	34	33.5	....	17.5	....	....
Do	9.1.5.543	do	do [11]	150	176	39	38	21	18	15	2–2
Do	9.1.5.544	do	do [7]	145	158	38	38.5	....	17.5	14	2–2
Do	9.1.5.545	do	do [10]	125	178	36	33.5	....	17.5	....	....
Do	9.1.5.546	do	do [10]	115	145	36	....	....	....	....	....
Do	9.1.5.547	do	Slightly	145	175	38	38.5	21	17.5	14	2–2
Do	9.1.5.548	do	None [12]	135	154	37	36.5	19	17	13.5	....
Do	9.1.5.549	do	Moderately	150	172	37	38.5	21.5	17	14	2–2
Do	9.1.5.550	do	None [7]	145	170	37	37	....	18	14	....
Do	9.1.5.551	do	do [10]	125	173	38	34	....	17	....	....
Java, Tji Wangie, Preanger, 4,000 feet.	9.1.5.561	Male	Moderately	150	165	37	40	23	17	14.5	....
Do	9.1.5.562	Female.	Slightly	155	150	39	....	....	....	14	....
Java, Buitenzorg	9.1.5.556	Male	None [11]	....	....	....	38	21	17.5	14.5	....
Java, Buitenzorg, 855 feet.	9.1.5.552	do	Slightly	145	170	36	38	21	16.5	14	....
Do	9.1.5.553	do	Moderately	150	170	38	40.5	23	17	14.5	....
Do	9.1.5.554	do	Slightly	140	165	38	39	21.5	17.5	14.5	....
Do	9.1.5.555	do	None [10]	120	150	37	33	....	17	....	....
Do	9.1.5.557	Female.	do [10]	110	140	34	32	16.5	17	....	....
Do	9.1.5.558	do	do [11]	140	165	36	37.5	....	17.5	14	....
Java, Tjilatjap, sea level.	9.1.5.560	do	Slightly	160	165	37	....	....	....	14	....
Do	9.1.5.559	Male	None [13]	145	162	36	....	....	....	13.5	....
Java, Tjigombong	99.8.6.45	do	do [7]	13.6	16.4	37	37	21	....	14	....
Java, Kedirie	83.8.13.1 [8]	do	Immature	111	125	37	....	....	....	....	....
Do	83.8.13.2 [8]	Female.	do	120	130	35	....	....	....	....	....

[1] m^1 halfway up.
[2] m^1 not quite level with tooth row.
[3] Wm. Palmer, collector.
[4] Not quite adult.
[5] pm^4 not quite in place, dpm^3 still in place.
[6] Cotype.
[7] di_1, di^2 still in place.
[8] Preserved in alcohol.
[9] No skin.
[10] m^1 last tooth in place.
[11] i^1 just appearing.
[12] m^2 last in place.
[13] dpm^4 still in place.

Measurements of Tupaia javanica—Continued.

Locality.	Number.	Sex.	Molar teeth worn.	Head and body.	Tail.	Hind foot.	Condylo-basal length.	Zygomatic width.	Width of brain case.	Maxillary tooth row.	Number of mammæ.
				mm.	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	
Java	Berlin, 654 [1]			165±	135±	36					
Do	Berlin, 636 [2]			170±	150±	37					
Do	Berlin, 633 [3]			165±	140±	36					
Java, Negrok, Preanger.	Berlin, 11352		Slightly				40	21.5	18	15	
Sumatra, Pajo	79.6.28.16		Moderately			37	39±		17.5	14	
Do	79.6.28.17	Female	do			37				14.5	2-2
Do	79.6.28.18		do			36				14.5	
Sumatra, Si Rambi	Genoa [4]	Male	Adult	125	145	37					
Do	do [4]	do	Young [5]	115	125	33					
Do	do [4]	do	Adult	125	135	37					
Do	do [4]	Female	do	135	150	36					2-2
Do	do [4]	do	do	135	150	38					2-2
Do	do [4]	do	do	135	150	36					2-2
Sumatra, Mount Singalang.	do [6]		Nearly adult. [7]	165±	155±	40±	38		18.5	14.5	
Do	88.12.1.7 [4]	Male	Adult	145	150	37					
Do	88.12.1.8 [4]	Female	do	145	160	38					2-2
Nias Island, Sitoli	Genoa [8]	Male	Moderately	150±	155±	38±	39±	23	17.5	14.5	

[1] Mounted specimen, collected by Temminck.
[2] Mounted specimen, collected by Kinder.
[3] Mounted specimen, collected by Becker.
[4] Specimen collected by Modigliani. Preserved in alcohol.
[5] *dpm*[4] last tooth in place.
[6] Mounted specimen, collected by Beccari.
[7] *dpm*[4] still in place.
[8] Mounted specimen, collected by Modigliani.

TUPAIA MINOR Günther.

(References, synonymy, type specimens, etc., under the subspecies.)

Geographic distribution.—Borneo, the adjacent islands of Banguey and Laut; Sumatra; southern portion of Malay Peninsula; islands of Linga and Singkep. See Nos. 2, 3, and 4 on map on page 111.

Diagnosis.—The smallest member of the genus *Tupaia* characterized by a uniformly grizzled olivaceous style of coloration, tail longer than head and body, enlarged central upper incisors and lower canine, like those of *T. javanica*, and a short stubby rostrum, so that the distance between the two lachrymal notches equals the distance from the notch to the front of the central upper incisor; mammæ, 2-2=4.

Color.—Upper parts and sides of head, neck, and body and outer side of legs and the feet a fine grizzle of blackish and a color that varies from cream buff to russet, the russet color when present being always more prominent posteriorly. The general effect is very similar to that seen in *Tupaia javanica*, but in that species a russet tinge is practically lacking. Tail a coarse grizzle of black and buff or ochraceous buff, the darker color predominating except at base of tail, which is generally colored like the back. Underparts of head, neck, and body and inner side of legs varying from whitish to buff, the hairs not at all or scarcely darker at their bases. Underside of tail generally similar to upper side except along the middle line, where the buff-ochraceous color predominates instead of the blackish. Shoulder stripe conspicuous, whitish or buffy.

Skull and teeth.—The skull and teeth of *Tupaia minor* are the smallest of any member of the genus. The rostrum is relatively very short and stubby, and the brain case appears large and rounded in contrast. The distance between the two lachrymal notches is about equal to the distance from that notch to the front of the central upper incisors. In *Tupaia javanica* the distance between the two lachrymal notches is equal to the distance from the notch to the space between the first and second upper incisors. The whole shape of the skull of *Tupaia minor* is quite unlike that of *Tupaia javanica* or other species of *Tupaia* except *Tupaia gracilis*, which has a skull of the same general style as *Tupaia minor* but slightly larger. The teeth of *Tupaia minor* are of the same form as those of *T. javanica* and *T. nicobarica*. The central upper incisors are large and heavy in comparison with most species of *Tupaia*, and the lower canines strongly developed and the third lower incisor correspondingly reduced in size. Quite a little variation in the shape and size of the skull of *Tupaia minor* appears to exist, more so than is usually seen in most species of *Tupaia;* most of it, however, may be accounted for by differences in age.

Subspecies.—Three geographic races of *Tupaia minor* are here recognized—typical *minor*, the most distinct of them confined to Borneo; *malaccana*, occurring in Sumatra, the Malay Peninsula, and the island of Linga; and what is in reality a subspecies of this form, occurring on the island of Singkep.

Remarks.—*Tupaia minor* is a well-marked species. It differs from *T. javanica* in being smaller, in having light, clear-colored underparts, and in its peculiar form of skull. It differs from *Tupaia gracilis* in its smaller size, less bushy tail, and in having teeth like those of *T. javanica* and not like those of *T. glis ferruginea*. The forms of *Tupaia minor* recognized here are perhaps as distinct as some forms often recognized as species, but the three are so closely allied to one another and they form such a compact group that it is a matter of great convenience to regard them as all belonging to one species. The available material of this species is not entirely satisfactory, although a large number of specimens exists in various museums, much of it is unsuited for systematic work, and many of the specimens are immature.

TUPAIA MINOR MINOR Günther.

1876. *Tupaia minor* GÜNTHER, Proc. Zool. Soc. London, 1876, p. 426.

1888. *Glipora leucogaster* JENTINK, Cat. Syst. Mamm. Mus. Hist. Nat., vol. 12, p. 116, 1888. A manuscript name of Diard, published by Jentink in a list of specimens of *Tupaia javanica*. As *T. javanica* does not occur in Borneo, and the two specimens have white bellies, they are probably examples of this species. Type-locality Pontianak, western Borneo.

Type-locality.—Borneo, opposite the island of Labuan.

Type-specimens.—In the British Museum, five cotypes, Reg. Nos. 76.5.2.21, 76.5.2.22, 76.5.2.23, 76.5.2.24, 76.5.2.25, skins and skulls,

MAP OF THE MALAY REGION, SHOWING THE DISTRIBUTION OF THE MINOR, GRACILIS, AND JAVANICA GROUPS OF THE GENUS TUPAIA. 1—TUPAIA JAVANICA; 2—T. MINOR MINOR; 3—T. MINOR MALACCANA; 4—T. MINOR SINCIPIS; 5—T. GRACILIS GRACILIS; 6—T. GRACILIS INFLATA; 7—T. GRACILIS EDARATA.

all collected on the Bornean mainland, opposite the island of Labuan, by Mr. Hugh Low; skins in fair condition; skulls all considerably damaged in occipital region.

Geographic distribution.—Throughout the island of Borneo, and the island of Banguey at the northeastern extremity, and the island of Laut at the southeastern extremity of Borneo. See No. 2 on map on page 111.

Diagnosis.—This subspecies is distinguished from the others in having a distinct russet wash over the lower back and slightly extended on to base of tail and in having the tails very dark and blackish.

Skull and teeth.—There are no characters by which the skulls and teeth of *Tupaia minor minor* may be distinguished from those of the other subspecies. (Plate 10, fig. 3.)

Measurements.—For measurements of the five cotypes see table, page 113. Usual measurements of adults: Head and body, 125–130 mm.; tail, 145–160; hind foot, 32–33; condylobasal length, 32–34; zygomatic width, 19–20; width of brain case, 16–17; maxillary tooth row, 12–12.5. For individual measurements, see table, page 113.

Remarks.—*Tupaia minor minor* is widely distributed throughout Borneo and appears fairly constant in its characters. There is some variation in the distinctness of the shoulder stripe. The shoulder stripe in the cotypes is rather dull and inconspicuous, but in a specimen from the Trusan River, close to the locality of the cotypes, the shoulder stripes are quite white and conspicuous, nearly as much so as are those in the specimens from Mount Dulit, which have very conspicuous shoulder stripes. The four mounted Sarawak skins in Genoa also have very distinct whitish shoulder stripes. The single specimen from Palo Laut has the tail darker than usual, while in the specimen from Banguey the tail is lighter.

Müller and Schlegel [1] did not distinguish between the three groups—*javanica, minor, gracilis*—of the small long-tailed olivaceous tree shrews, but grouped them all as *Tupaia javanica*. The skull of a young individual illustrated on plate 27,[1] figures 13 and 14, is apparently an example of *Tupaia minor* and not of *T. javanica*. The other figures on that plate intended for *T. javanica* undoubtedly represent that species.

The skins recorded as *Tupaia javanica* from Pontianak, Borneo, by Jentink [2] are probably examples of *T. m. minor*.

Concerning its habits, Hose[3] remarks: "This little tree shrew is fairly common, both on the mountains to a height of 4,000 feet and in the low country. It breeds in a nest in an old stump covered with creepers, but I am not sure whether it makes the nest itself or occupies the nest of a bird. I have found two of these nests, but the material used was different."

Specimens examined.—Twenty-two. See table, page 113.

[1] Verh. Nat. Gesch. Ned. Overz. Bez., 1839–44, p. 165, pls. 26 and 27.
[2] Cat. Syst. Mamm. Mus. Hist. Nat., vol. 12, 1888, p. 116.
[3] Mammals of Borneo, 1893, p. 30.

Measurements of Tupaia minor minor.

Locality.	Number.	Sex.	Molar teeth worn.	Head and body.	Tail.	Hind foot.	Condylo-basal length.	Zygomatic width.	Width of brain case.	Maxillary tooth row.	Number of mammæ.
				mm.	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	
Borneo, Sempang River, at mouth.	145575	Female	Slightly	130	156	33	33.5	19	15.5	12.5	2–2?
Borneo, Kendawangan River.	153857	Male	do	132	148	33	33.5	19.5	16	12	....
Borneo, Pulo Laut, southeast coast.	151881	do	Moderately	130	145	33	.....	.....	.....	12.5	....
Baram River, northwest Borneo.	88.8.13.5	.....	None	.....	.....	33	32±	19.5	15.5	12	....
Mount Dulit, 4,000 feet.	92.2.7.9	Female	do	.....	.....	32	.....	.....	17	12.5	2–2
Mount Dulit, 4,500 feet.	92.2.7.8	Male	None [1]	.....	.....	34	34	19	16.5	12.5	....
Mount Dulit, 4,000 feet.	8.1.27.4	Female	.....	.....	.....	34	.....	.....	.....	.....	2–2
Mount Dulit, 2,000 feet.	99.12.9.11	Male	Slightly	.....	.....	32	32	19	16	12	....
Kina Balu, 3,000 feet.	93.4.1.4	.....	None [2]	.....	.....	33	32.5	19	15	12	....
Tutau River	94.6.2.5	Male	Slightly	.....	.....	35	33	20.5	16.5	11.5	....
Trusan, opposite Labaun.	88.8.13.6	Female	do	.....	.....	36	33.5	.....	16	12.5	2–2
Mainland, opposite Labaun.	76.5.2.25 [3]	.....	Moderately	.....	.....	33	.....	.....	.....	12.5	....
Do	76.5.2.22 [3]	.....	Slightly	.....	.....	33	.....	.....	.....	12	....
Do	76.5.2.21 [3]	.....	Moderately	.....	.....	33	.....	19.5	15.5	12.5	....
Do	76.5.2.23 [3]	.....	None [4]	.....	.....	33	33	19	17	12.5	....
Do	76.5.2.24 [3]	.....	Moderately	.....	.....	34	33±	20	15.5	12.5	....
Sarawak	7.1.1.51	Male	do	.....	.....	32	34	21	16.5	12.5	....
Pocrock Tjahoe, 115 feet, Barito River, central Borneo.	10.4.5.78	do	None [5]	118	150	32	31.5	19	16.5	11.5	....
Do	10.4.5.79	do	Slightly	122	160	31	32	19	16.5	11.5	....
Moera Tewe, south central Borneo, Barito River, 65 feet.	10.4.5.80	do	None [6]	97	135	30	.....	.....	.....	.....	....
Karanginton, Martapoera River, 30 feet.	10.4.5.77	Female	Slightly	130	150	30	32	19	16	11.5	2–2
Hilly country, south Borneo.	10.4.5.76	Male	do	128	160	32	33	19.5	16.5	12.5	....
Banguey Island	94.7.2.9	do	Moderately	.....	.....	31	.....	.....	.....	12.5	....
Bidi Caves, Sarawak, Bidi.	3.3.31.2 [7]	do	None [6]	100	135	31	.....	.....	.....	.....	....
Lower Padas River, north Borneo.	94.7.2.56 [7]	do	Adult	125	150	33	.....	.....	.....	.....	....
Sarawak, Borneo	Genoa, 143	do	do	125	145	33	.....	.....	.....	.....	....
Do	do	Female	Immature	115	115	33	.....	.....	.....	.....	....
Do	Genoa, 4L [8]	.....	Slightly	115	125	33	32.5	20	17	12.5	....
Do	Genoa, 4C [9]	Male	.....	115±	130±	30±	.....	.....	.....	.....	....
Do	Genoa, 4D [9]	do	.....	120±	130±	32±	.....	.....	.....	.....	....
Do	Genoa, 4F [9]	do	.....	120±	125±	32±	.....	.....	.....	.....	....
Do	Geona, 4G [9]	Female	.....	130±	130±	32±	.....	.....	.....	.....	....
Mount Dulit, 2,500 feet, Borneo.	Genoa, Hose	do	.....	150±	150±	33	.....	.....	.....	.....	2–2
Mount Dulit, 1,000 feet.	Berlin, Hose	do	.....	170±	160±	32	.....	.....	.....	.....	....
Do	do	Male	.....	150±	150±	32±	.....	.....	.....	.....	....
Darvel Bay, Borneo.	Berlin, Pagel	.....	Slightly	135±	135±	.....	33	19	16.5	12.5	....
Borneo	Berlin, 5127	.....	Moderately	.....	.....	32	.....	.....	16.5	13	....
Do	Paris, 676 [9]	.....	.....	.....	.....	32±	.....	.....	.....	.....	....
Do	Paris, 676 bis [9]	.....	.....	.....	.....	32±	.....	.....	.....	.....	....
Do	Paris, 49	.....	.....	140±	125±	32±	.....	.....	.....	.....	....
Sarawak, Borneo	Turin, 2114 [7]	Male	Adult	140	155	34	.....	.....	.....	.....	....

[1] i^1, just appearing.
[2] i^2 and pm^3, just appearing.
[3] Cotype.
[4] Permanent incisors, just appearing.
[5] di^1 and di^2, still in place.
[6] m^1, last tooth in place.
[7] Preserved in alcohol.
[8] Skeleton.
[9] Mounted.

TUPAIA MINOR MALACCANA Anderson.

1879. *Tupaia malaccana* ANDERSON, Zool. Res. West. Yunnan, p. 134, pl. 7, fig. 16.

Type-locality.—Malacca, Malay Peninsula.

Type-specimen.—The two specimens on which Anderson's description was based are said by him to have been "procured at Malacca and referred by Blyth to *T. javanica.*" They are without doubt No. 242, "A. B. Specimens from Malacca, and C. Skull, presented by Mr. Frith (1846)," (p. 82), in the Catalogue of the Mammalia in the Museum Asiatic Society, by Edward Blyth, 1863. I have not seen the specimens.

Geographic distribution.—Southern end of Malay Peninsula, Selangor, Malacca, Johore, Sumatra, and the island of Linga. See No. 3 on map on page 111.

Diagnosis.—*Tupaia minor malaccana* differs from the other subspecies of *Tupaia* in having the tail more like the general color of the head and body, less blackish, and in having less of a chestnut or russet wash on posterior half of body.

Skull and teeth.—These show no characters but slightly larger size to distinguish them from the other subspecies. (Plate 10, fig. 4.)

Measurements.—Usual measurements of adults: Head and body, 125–140 mm.; tail, 150–165; hindfoot, 32–34; condylobasal length, 33–35; zygomatic width, 20–21; width of braincase, 16–17; maxillary toothrow, 12–13. The measurements are nearly all very slightly larger than the corresponding ones in *Tupaia minor minor.*

Remarks.—*Tupaia minor malaccana* is not a very different form from *T. m. minor.* Although *T. m. minor* was described in 1876, Anderson in describing *T. m. malaccana* in 1879 did not seem to be aware of Günther's work. If he had, he would probably have identified the Malaccan specimens with it. The specimens that I have identified as *T. m. malaccana* show a few variations. The Linga specimens seem to be slightly larger than the others, and are rather intermediate in color between the subspecies from Singkep and typical *T. m. malaccana,* but generally more like the Malaccan specimens. The Sumatra skins as a whole, especially shown in one from the Indragiri River, have a greater tendency to a russet wash on the lower back than the Peninsular skins. Specimens of *T. m. malaccana* are recorded by Schneider[1] from Unter Lankat, Sumatra. The specimen "*ee,*" recorded by Jentink[2] as *Tupaia javanica* from Deli, Sumatra, is probably an example of *T. minor malaccana.* The other Sumatra specimen, *c,* from Upper Padang, and *c–i,* may be the present species or may be examples of *T. javanica.*

Specimens examined.—Ten from Malay Peninsula, 6 from Sumatra, and 4 from Linga Island.

[1] Zool. Jahrb., vol. 23, Heft 1, 1905, p. 88.
[2] Cat. Syst. Mamm. Mus. Hist. Nat., vol. 12, 1888, p. 117.

Measurements of Tupaia minor malaccana.

Locality.	Number.	Sex.	Molar teeth worn.	Head and body.	Tail.	Hind foot.	Condylo-basal length.	Zygomatic width.	Width of brain case.	Maxillary tooth row.	Number of mammæ.
				mm.	*mm.*	*mm*	*mm.*	*mm.*	*mm.*	*mm.*	
Selangor, Batu	152186	Female	Moderately	120	159	33	32.5	19.5	16	12	2-2
Johore, Sungei Malayu	143271	do	do	135	160	33	33	20	16.5	12	2-2
Johore, Sembrong River	112618	Male	do	139	146	33	34.5	21	16.5	12.5	....
Johore	85.8.1.95.	.....	None	.....	.....	32	.....	19	.....	12	....
Ka Aming, Johore	5.12.7.8.	Male	do	130	160	32	33.5	20.5	16.5	12	....
Ka Kuli, Southwest Johore.	5.12.7.9.	Female.	Slightly	130	150	34	33.5	.....	16.5	12.5	2-2
Selangor	85.8.1.96.	do	In skin	.....	.....	32	.....	.....	.....	.....	2-2
Semang Ko Pass, Selangor, Pahang boundary, 2,509–4,500 feet.	8.7.20.11.	Male	None [2]	121	154	33	33.5	18.5	16	12	....
Do	8.7.20.12.	do	do.[3]	117	138	34	.....	.....	.....	12	....
Cheras, Selangor	8.7.20.13.	Female.	do	130	150	33	32	20	17	12	....
Sumatra Indragiri River.	113166	do	Slightly	125	150	33	33	20	16.5	12.5	....
Sumatra, Tarussan Bay	141076	do	Moderately.	136	156	33	35.5	21.5	16.5	12.5	....
Sumatra, Tapanuli Bay	114550	do	Slightly	132	152	32	35±	19.5	17	13	....
Sumatra	64.4.12.4.	do	None [1]	.....	.....	35	.....	.....	.....	12	....
South Sumatra	81.3.15.5.	.....	do	.....	.....	33	.....	.....	16.5	12.5	....
Talum, Upper Batang, Padang, Sumatra.	3.2.5.1.	Male	Moderately.	142	165	35	34	20	17	12.5	....
Linga Island, Peak, 2,000 feet.	101598	do	do	133	165	31	34.5	20.5	16.5	12.5	....
Do	101600	do	do	140	165	33	35±	21.5	17	13	....
Linga Island, west coast.	113068	do	Moderately.	141	156	34	34.5	21.5	17	13	....
Do	101599	Female.	do	140	165	33	35.5	21	17	13	2-2

[1] di^1 and di^2 still in place. [2] i^2 just appearing. [3] m^3 appearing.

TUPAIA MINOR SINCIPIS Lyon.

1911. *Tupaia sincipis* LYON, Proc. Biol. Soc. Wash., vol. 24, p. 169, June 16, 1911.

Type-locality.—Sinkep Island, between the Malay Peninsula and Sumatra.

Type-specimen.—In United States National Museum. Cat. No. 123105, skin and skull of adult male, collected on Pulo Sinkep, August 8, 1903, by Dr. W. L. Abbott; original number, 2732; in good condition.

Geographic distribution.—Pulo Sinkep. See No. 4 on map on page 111.

Diagnosis.—Tupaia minor sincipis differs from the other subspecies in being slightly larger. Hind foot, 34–35 mm.; maxillary tooth row, 13–13.5, instead of 32–34 and 12–13; the color of the back is much more russet than it is in the other forms; the tail is dark and blackish, as in the Bornean subspecies.

Skull and teeth.—Except for their slightly larger size the skull and teeth of *Tupaia minor sincipis* do not show any appreciable differences from those of the other subspecies.

Measurements.—Type and a second adult: Head and body, 140 mm., 130; tail, 165, 160; hind foot, 35, 35; condylo-basal length, 36.5,

34.5; zygomatic width, 20.5, 19.5; width of brain case, 16.5, 16.5; maxillary tooth row, 13.5, 13. See table below.

Remarks.—*Tupaia minor sincipis* is a fairly distinct form; it is sufficiently distinguished by its slightly larger size and more russet color of the lower back. It is rather closely approached by the small tree shrews of the neighboring island of Linga, which specimens are rather intermediate between *T. m. sincipis* and *T. m. malaccana*, but in general more like the latter form. The Sinkep specimens have previously been identified as *T. malaccana*.[1]

Specimens examined.—Six from Sinkep Island.

Measurements of Tupaia minor sincipis.

Locality.	Number.	Sex.	Molar teeth worn.	Head and body.	Tail.	Hind foot.	Condylo-basal length.	Zygomatic width.	Width of brain case.	Maxillary tooth row.	Number of mammæ.
				mm.	*mm.*	*mm*	*mm.*	*mm.*	*mm.*	*mm.*	
Pulo Sinkep	123105[1]	Male	Moderately.	140	165	35	36.5	20.5	16.5	13.5	....
Do	113145	Female.	None [2]	133	180	34	35±	19	16.5	13.5	....
Do	113146	do	Slightly [3]	130	160	35	34.5	19.5	16.5	13	....
Do	123104	do	None [4]	127	150	34	34	18	16.5	12.5	....
Do	123106	do	do.[5]	130	160	34	34.5	19	16.5	13	....
Do	123107	do	do.[5]	120	150	34	31	.....	16.5	13	....

[1] Type. [2] *pm.*[4] just appearing. [3] *dl*,[1] *di*[2], *dc*[1] still in place.
[4] *dpm*[3], *dpm*[4] still in place. [5] *m*[3] just appearing.

TUPAIA GRACILIS Thomas.

(Synonymy, type locality, etc., under the subspecies.)

Geographic distribution.—Borneo, and the islands of Karimata, Billiton, and Banka, west of Borneo. See Nos. 5, 6, 7 on map on page 111.

Diagnosis.—One of the small long-tailed olivaceous members of the genus *Tupaia* intermediate in size between *Tupaia javanica* and *T. minor;* skull of the same general shape as that of *T. minor*, only larger, but teeth resemble those of *T. glis ferruginea* in form, that is, central upper incisors and the lower canines are not unusually enlarged as they are in *T. javanica*. Number of mammæ not known.

Color.—General color effect of upper parts of head, neck, and body and outer side of legs olive often washed with russet posteriorly, produced by a very fine (much finer than that of *Tupaia minor*), grizzle of blackish and a color that varies from cream buff to russet, the latter color when present more prominent posteriorly; underparts, including inner side of legs whitish to buff in color, sometimes with dark bases of the hairs showing through, especially on hind legs, rarely with indications of grizzling, but never so dark or grizzled as

[1] Miller, Proc. U. S. Nat. Mus., vol. 31, p. 272, Sept. 11, 1906. Lyon, Proc. U. S. Nat. Mus., vol. 36, p. 490, June 1, 1909.

in *Tupaia javanica* and usually of a less clear whitish or buff color than in *T. minor;* tail, long, soft, and more distichously haired than in either *T. javanica* or *T. minor*, the upper surface a fine grizzle of blackish and buffy or sometimes russet, the darker color in excess; underside of tail similar, but the dark element less conspicuous, except along the edges and at tip, on either side of middle line a clear or nearly clear area of the buff or russet color; shoulder stripe light buffy in color, less conspicuous than it is in *Tupaia minor.*

Skull and teeth.—The skull of *Tupaia gracilis* is of the same general shape as that of *T. minor*, with a rather large inflated brain case and a short stubby rostrum, but as a whole the skull is larger and the brain case relatively more enlarged. The teeth are strikingly different from those of *Tupaia minor* or *T. javanica* in the moderate development of the central upper incisors, the lack of special development of the lower canines, and the relatively greater size of the third lower incisor. The teeth are essentially of the same form as those of *Tupaia glis ferruginea*, while the skull as a whole is essentially of the form of that of *T. minor.*

Subspecies.—Three subspecies of *Tupaia gracilis* are here recognized, the typical form on Borneo, a race on Karimata and another on Banka and Billiton.

Remarks.—*Tupaia gracilis* is a very distinct species and its combination of external, cranial, and dental characters serve to distinguish it very clearly from *T. javanica* and *T. minor*, which resemble it superficially. The available material of *T. gracilis* is even more unsatisfactory than that of *T. minor.* It is apparently a rare animal and many of the specimens are not fully adult, or are not in the best condition for systematic work. The distribution of this species is rather limited. Outside of Borneo the only islands on which it occurs are islands whose fauna is very closely related to that of Borneo.

TUPAIA GRACILIS GRACILIS Thomas.

1893. *Tupaia gracilis* Thomas, Ann. Mag. Nat. Hist., ser. 6, vol. 12, p. 53, July, 1893.

Type-locality.—Apoh River, base of Mount Batu Song, Baram District, northern Borneo.

Type-specimen.—In British Museum, Reg. No. 92.9.6.2. Collected on Apoh River, base of Mount Batu Song, northern Borneo, in September, 1891, by A. H. Everett; skin in good condition, but skull with occipital region and basal parts of brain case broken away.

Geographic distribution.—Probably generally distributed throughout Borneo; specimens in collection are known only from Baram District and southwestern Borneo. See No. 5 on map on page 111.

Diagnosis.—*Tupaia gracilis gracilis* is the largest of the three subspecies, hind foot over 40 mm., without special peculiarities of color, less russet color present posteriorly, and slightly larger skull.

Measurements.—Type: Head and body (from dried skin), 155 mm.; tail (from dried skin), 160; hind foot, 40; zygomatic width, 20.5; width of brain case, 17.5 ±; maxillary tooth row, 14. Usual measurements of adults: Head and body, 140–150; tail, 155–170; hind foot, 40–42; condylo-basal length, 36–36.5; zygomatic width, 20.5–21; width of brain case, 17.5; maxillary tooth row, 13–14. See also table, page 119.

Specimens examined.—Ten, including the type from Baram District, northern Borneo, and one from southwestern Borneo. See table, page 119.

TUPAIA GRACILIS INFLATA Lyon.

1906. *Tupaia inflata* Lyon, Proc. U. S. Nat. Mus., vol. 31, p. 600, December 18, 1906.

Type-locality.—Tanjong Rengsam, Island of Banka.

Type-specimen.—In United States National Museum, Cat. No. 124709. Skin and skull of adult male, collected at Tanjong Rengsam, Banka, May 20, 1904, by Dr. W. L. Abbott; original number, 3241; skin and skull in good condition.

Geographic distribution.—Islands of Banka and Billiton. See No. 6 on map on page 111.

Diagnosis.—Of the same general color as *Tupaia gracilis gracilis*, but with more of a russet tinge posteriorly, hind foot slightly smaller, not exceeding 40 mm.; skull with relatively larger bullæ. (Plate 10, fig. 2.)

Measurements.—Type: Head and body, 150 mm.; tail, 172; hind foot, 37; condylo-basal length, 37; zygomatic width, 21; width of brain case, 17.5; maxillary tooth row, 13.5. Usual measurements of adults: Head and body, 140–150; tail, 160–170; hind foot, 37–39; condylo-basal length, 36–37; zygomatic width, 20–21; width of brain case, 16.5–17.5; maxillary tooth row, 13–13.5. See table, page 119.

Remarks.—*Tupaia gracilis inflata* is only slightly differentiated from *T. g. gracilis*. At the time it was originally described it was compared with *T. javanica* and *T. minor*, and of course appeared to be a very distinct form. It is well established now that it has nothing in common with those two species. Two of the specimens, Cat. No. 124985, Billiton, and Cat. No. 124909, Banka, have the tails very different in color from other specimens, the usual buffy annulations being replaced by russet or tawny ochraceous; it appears to be a difference in pelage.

Specimens examined.—Three, including the type, from Banka, and three from Billiton.

TUPAIA GRACILIS EDARATA, new subspecies.

Type-locality.—Telok Edar, Karimata Island, off west coast of Borneo.

Type-specimen.—In United States National Museum, Cat. No. 153859, skin and skull of young adult female, collected on Karimata

Island by Dr. W. L. Abbott, October 5, 1908; original number, 6226; skin in good condition; skull imperfect.

Geographic distribution.—Known only from Karimata Island. See No. 7 on map on page 111.

Diagnosis.—Characterized by having the general olivaceous color of the upper parts strongly approaching bister, the effect produced by a fine grizzling of blackish and ochraceous; tail more brownish and less different in color from head and body than in the case of the other subspecies; light colors of underside of tail distinctly ochraceous.

Skull and teeth.—There are no characters by which the skull and teeth of *Tupaia gracilis edarata* may be distinguished from those of *T. g. inflata.*

Measurements.—Type: Head and body, 135 mm.; tail, 156; hind foot, 38; condylo-basal length, 36±; zygomatic width, 19; width of brain case, 17; maxillary tooth row, 13.

Remarks.—*Tupaia gracilis edarata* is more like the subspecies *inflata* than the typical form and I identified it as *Tupaia inflata* in 1911.[1] It is browner than any of the Banka-Billiton specimens, and although based on the examination of but a single skin it is apparently a fairly well defined geographic form.

Specimen examined.—One, the type.

Measurements of Tupaia gracilis.

Name.	Locality.	Number.	Sex.	Molar teeth worn.	Head and body.	Tail.	Hind foot.	Condylo-basal length.	Zygomatic width.	Width of brain case.	Maxillary tooth row.	Number of mammæ.
					mm.	*mm.*	*mm*	*mm*	*mm*	*mm*	*mm*	
T. gracilis gracilis.	Borneo, Kendawangan River.	153858.....	Male...	Slightly....	143	174	40	36	21	17.5	13	..
Do....	Borneo, foot of Batu Song.	92.9.6.2 [2].....	...do...	None.....	155±	160±	40	....	20.5	17.5±	14	..
Do....	Claudetown, Baram, Sarawak.	0.7.29.21 [3]....	...do...	.....do.[4]....	140	170	42	....	....	.....	....	..
Do....	Sarawak, Borneo.	88.12.1.6 [3]....	...do...	.....	140	165	43	....	....	.....	....	..
Do....	.....do.....	Genoa, 142 [3].	...do...	Adult.....	140	155	40	....	....	.....	....	..
Do....	.....do.....	Genoa [3].....	...do...	.....do.....	140	160	41	....	....	.....	....	..
Do....	.....do.....	Genoa, 4K [5].	.....	Moderately	135	140	40	36.5	21	17.5	13.5	..
Do....	.....do.....	Genoa, 4E..	.....	.....	135±	130±	38±	....	....	.....	....	..
Do....	.....do.....	Genoa, 4B..	.....	.....	130±	140±	38±	....	....	.....	....	..
Do....	.....do.....	Genoa, 4A..	.....	.....	140±	135±	40±	....	....	.....	....	..
Do....	.....do.....	Berlin, 4459 [3]	Male...	None.....	135	145	40	37	21	17	13.5	..
T. gracilis inflata.	Banka, Tanjong Rengsam.	124709 [2].....	...do...	Moderately	150	172	37	37	21	17.5	13.5	..
Do....	Banka, T. Mengkudu.	124909.....	...do...	Slightly....	140	175	38	35.5	20	17.5	13	..
Do....	.....do.....	124910.....	Female	.....do.[6]...	140	162	37	35	20±	17±	13	..
Do....	Billiton, T. Batu.	124946.....	Male...	Moderately	140	165	40	36	21	16.5	13.5	..
Do....	.....do.....	124947.....	...do...	.....do.....	140	170	38	35.5	21	17.5	13.5	..
Do....	Billiton, Buding Bay.	124985.....	...do...	None.[7].....	130	168	39	35±	19.5	17.5	13.5	..
T. gracilis edarata.	Karimata Island.	153859 [2].....	Female	Slightly....	135	156	38	36±	19	17	13	..

[1] Proc. U. S. Nat. Mus., vol. 40, p. 122, Apr. 25, 1911.
[2] Type.
[3] Preserved in alcohol.
[4] m^3 nearly in place.
[5] Skeleton.
[6] i^1 and i^2 not fully in place.
[7] dpm^3 still in place, pm^4 halfway through.

ANATHANA, new genus.

Type.—*Tupaia ellioti* Waterhouse, Proc. Zool. Soc. London, 1849, p. 107, Plate, mammalia, 13.

Diagnostic characters.—A member of the mammalian family Tupaiidæ differing from typical *Tupaia* as restricted on page 30 in having larger and better haired ears, coarser reticulations on naked area of nose; unusually well-developed hypocones on the upper molars, lower canines not projecting above the level of the adjacent teeth; relatively short and heavy rostrum; and a small and inconspicuous fenestra in zygoma.

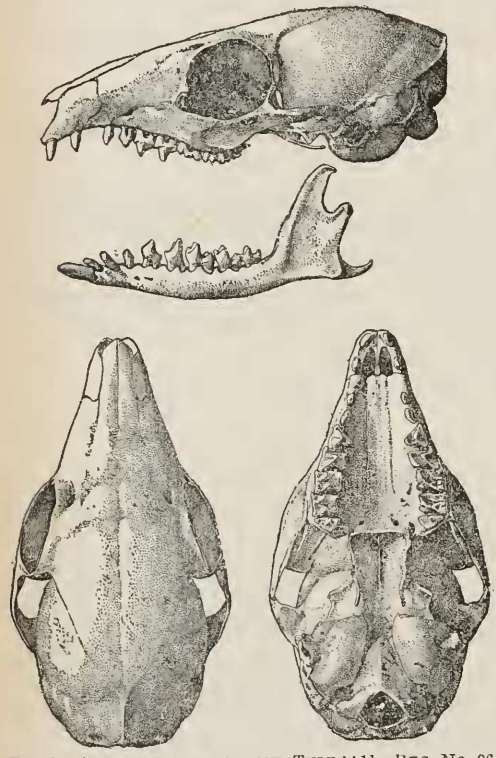


FIG. 6.—ANATHANA WROUGHTONI, TYPE × 1½. REG. NO. 96. 11. 7, 1, BRITISH MUSEUM, MANDVI, INDIA.

External characters.—Externally the genus *Anathana* is very similar to *Tupaia*, more like it than any other member of the family. The most tangible differences are the distinctly greater size of the lower portion of the external ear in comparison with the upper portion, due to a widening out of the lower lobe, which projects backward to a considerable extent, and slightly forward. The interior of the ear is much better haired than is the ear of *Tupaia*. The rhinarium is squarely cut across posteriorly as in *Tupaia*, but is apparently more coarsely reticulated than in *Tupaia* and the reticulations are more regularly arranged. The footpads in *Anathana* are essentially as they are in *Tupaia*, but on the hind foot the internal proximal pad is perfectly distinct from the first interdigital pad in the few specimens that have been suitable for making the observations; but in *Tupaia* itself this distinctness of the two pads is often indicated, but usually the two are fused to form one long pad. The pelage of *Anathana* appears distinctly coarser and harsher than that of *Tupaia*, and the grizzling of the colors is coarser, differences something like those seen between *Sciurus* and *Xerus*. Nearly all the skins of *Anathana* depending, however, a good deal upon the manner of arranging and

stuffing the head, show ill-defined but still evident light lines over and below the eye, thus suggesting the more pronounced face markings seen in most species of *Dendrogale*. A shoulder stripe is present. Mammæ are 3–3=6, 1 axillary, 1 inguinal, 1 ventral near the inguinal one. (Plate 4.)

Cranial characters.—The skull of *Anathana* shows little deviation from the typical *Tupaia* skull. The rostrum is short and heavy, does not arise from the skull abruptly as in the *Tupaia minor* group, where the rostrum is also relatively short. The distance from the lachrymal notch to end of premaxilla is about equal to the distance from that notch to end of external pterygoid plate. In *Tupaia*, with the exception of the *minor* group, the distance from the lachrymal notch to end of premaxilla equals the distance from the notch to the external auditory meatus. Correlated with the shortened rostrum the premaxilla is correspondingly short, antero-posteriorly and relatively high, supero-inferiorly. Usually in *Tupaia* the naso-premaxillary suture is considerably lengthened or apparently obliquely pushed backward, making the premaxilla a rather obliquely elongated bone. In *Anathana* the premaxilla is somewhat quadrate in shape and only slightly distorted. Extreme obliquity of the premaxilla is seen in the genus *Tana*. The fenestra in the zygoma in *Anathana* is reduced to a small oval foramen quite different from the large opening found in *Tupaia*. While it appears a trivial character, yet in the Tupaiidæ the size of this opening is an important feature correlated with other peculiarities. See fig. 6 on page 120.

FIG. 7.—UPPER AND LOWER TOOTH-ROWS OF ANATHANA WROUGHTONI TYPE × 3, REG. NO. 96. 11. 7. 1, BRITISH MUSEUM, MANDVI, INDIA.

Dental characters.—The most evident of the dental characters in *Anathana* is the relatively small size of the lower canine, so that when the lower jaw is viewed from the side this tooth does not stand conspicuously higher than the adjacent incisor and premolar. The development of hypocones on the first and second upper molars is very conspicuous in *Anathana;* they are larger than in any other member of the family though nearly equalled by the hypocones on the first two upper molars of *Urogale* and *Ptilocercus*. All the upper molariform teeth of *Anathana* are relatively wider and shorter than they are in the other genera. This is especially well shown in the third and fourth premolars, where the protocones are better developed and extend inward toward the median line more than is the case in other genera of Tupaiidæ. Looked at on its grinding surface the fourth

premolar is distinctly four-sided in outline, while in *Tupaia* it is rather triangular. The third premolar in *Anathana* has a very evident protocone, while in *Tupaia* and *Tana* it is quite rudimentary. Corresponding with the conspicuous development of the protocones of the third and fourth premolars the metaconid of the fourth lower premolar is much increased in size as compared with its development in *Tupaia*. See fig. 7 on page 121.

A cecum about 25 mm. long is perhaps one of the generic characters. See page 14.

Geographic distribution.—*Anathana* is confined to the Indian peninsula, south of the River Ganges. The northeastern part of its range almost meets the southwestern limit of *Tupaia chinensis*. So far as our present knowledge goes the two genera do not overlap in their distribution. See map, page 125, Nos. 1, 2, 3.

Number of forms.—The genus *Anathana* contains but a single species group, easily separable into three forms. Perhaps they are nothing more than subspecies, but material is at present lacking to show intergradation.

Anathana ellioti, eastern India; upper parts and tail reddish brown, feet and hind legs buff or ochraceous, page 122.

Anathana pallida, northeastern India; upper parts a less conspicuous reddish brown, different in color from tail, feet and hind legs grizzled buffy, page 124.

Anathana wroughtoni, western India; upper parts dull grizzled brownish, tail slightly dissimilar, feet and hind legs grizzled grayish, page 123.

Remarks.—*Anathana* is clearly closely related to *Tupaia* in most of its characters. In the small size and oval shape of the zygomatic fenestra it resembles *Dendrogale*, as well as in the barely indicated face markings, which are even lacking in one species of *Dendrogale*. In the development of the hypocones of the upper molars and the protocones of the premolars it is approached by *Urogale* and *Ptilocercus*. It is quite distinct from any of the family in the relatively small size of the lower canines, and is the antithesis of *Urogale*, which has the lower canines exceedingly well developed.

ANATHANA ELLIOTI (Waterhouse).

1849. *Tupaia ellioti* Waterhouse, Proc. Zool. Soc. London, 1849, p. 107, plate, mammalia, 13.

1879. *Tupaia ellioti*, Anderson, Zool. Res. West Yunnan, 1879, p. 124, pl. 7, figs. 12 and 13.

1888. *Tupaia ellioti*, Blanford, Fauna Brit. Ind. Mamm., p. 209, 1888.

Type-locality.—Hills between Cuddapah and Nellore, eastern Ghats, India, not far from Madras.

Type-specimen.—In British Museum, Reg. No. 50.1.21.5, adult male, collected by W. Elliot, who procured specimens "from the hills between Cuddapah and Nellore in what may be termed the eastern

Ghats." The label of the specimen reads "Madras," the nearest large city to the locality mentioned by Waterhouse. The specimen is rather old, mounted, and without skull, but in a good state of preservation and apparently not injured as to color by exposure to light. There are two other specimens, paratypes, collected by Elliot at the same locality: 50.1.21.7, a young individual recently made into a modern study skin, in good condition and color, and with fragments of skull present, and 50.1.21.6, with skull, 50.8.21.16, an adult female, long mounted and much exposed to the light and so bleached that the grizzling is lost, and the brownish color of the back merely indicated.

Geographic distribution.—Eastern Ghats, and Sheveroy Hills to the south, India. See No. 1 on map on page 125.

Diagnosis.—Upper parts of body and tail distinctly reddish brown; feet buff to ochraceous.

Color.—Upper parts of body and tail a coarse grizzle of tawny ochraceous and blackish, the former much in excess and the grizzle coarser on the tail; head, neck, and sides of body a grizzle of ochraceous and blackish, both colors about equally mixed; outer side of legs similar to adjacent parts of body; underparts and inner side of legs buffy; upper surfaces of hands and feet, dark buff or ochraceous buff; shoulder stripe whitish cream color; underside of tail similar to upper side, except in the median line where the short appressed hairs have the general color of the underparts.

Skull and teeth.—There are apparently no characters by which the skull and teeth of *Anathana ellioti* may be distinguished from those of other species in the genus.

Measurements.—Type: All from skin, head, and body, 180± mm.; tail, 180±; hindfoot, 40. Skull of an adult paratype, Reg. No. 50.1.21.6, condylobasal length, 42; zygomatic width, 22.5; width of braincase, 17.5; maxillary toothrow, 16. External measurements of specimens preserved in alcohol: Head and body, 160–180; tail, 185–190; hindfoot, 44–45. See table, page 126.

Remarks.—The Sheveroy Hills specimen, represented by a flat skin with skull, is not typical, the head being darker, the back, and especially the tail being less reddish than in the Cuddapah specimens, but the underparts, feet, and underside of tail being distinctly buffy, as in the others.

Specimens examined.—Eight: 5 skins and 3 preserved in alcohol.

ANATHANA WROUGHTONI, new species.

Type-locality.—Mandvi, near Bombay, India.

Type-specimen.—In British Museum, Reg. No. 96.11.7.1, skin and skull of adult female, collected at Mandvi, near Bombay, India, March 21, 1896, by R. C. Wroughton; in good condition.

Geographic distribution.—Region of Satpura Hills, and Dangs, near Bombay, western India. See No. 2 on map on page 125.

Diagnosis.—Upper parts of body dull grizzled brownish, tail slightly dissimilar in color from body, feet and hind legs, grizzled grayish.

Color.—Same general pattern as in *Anathana ellioti*, but upper parts of body not a conspicuous reddish brown, but a grizzle of blackish and ochraceous; tail a coarse grizzle of buff and blackish, the latter color in excess; sides of head, neck, and body, and outer side of legs and feet a grizzle of pale or cream buff and blackish; underparts and inner sides of legs whitish; shoulder stripe whitish, but not conspicuous.

Skull and teeth.—There are no tangible characters by which the skull and teeth of *Anathana wroughtoni* may be distinguished from those of *A. ellioti*.

Measurements.—Type: Head and body, 177 mm.; tail, 187; hind foot, 44; condylobasal length, 42; zygomatic width, 22.5; width of braincase, 18; maxillary toothrow, 15.

Specimens examined.—Three, one each from Mandvi, Dangs, and Matheran.

Remarks.—The "Indian Tupaia," recorded in the Satpura Hills by Ball in 1874,[1] is undoubtedly this species.

ANATHANA PALLIDA, new species.

Type-locality.—Munbhum, northeastern India.

Type-specimen.—In British Museum, Reg. No. 66.12.28.2, skin and skull of young adult female, collected at Munbhum, India, in 1865 by R. C. Beavan; in good condition.

Geographic distribution.—Northeastern India, ranging from Raipur northeastward as far as the Ganges River. See No. 3 on map on page 125.

Diagnosis.—Generally paler in color than is *Anathana ellioti*, upper parts only slightly reddish brown; tail not concolor with body; hind feet and legs grizzled buffy.

Color.—Of the same general pattern as that of *Anathana ellioti*, but the reddish brown of the back is not nearly so dark or conspicuous, and is not continued on to the tail; tail similar in color to sides of body; shoulder stripe quite conspicuous and nearly clear white; underparts and inner side of legs whitish.

Skull and teeth.—These show no evident characters by which they can be distinguished from those of *Anathana ellioti*.

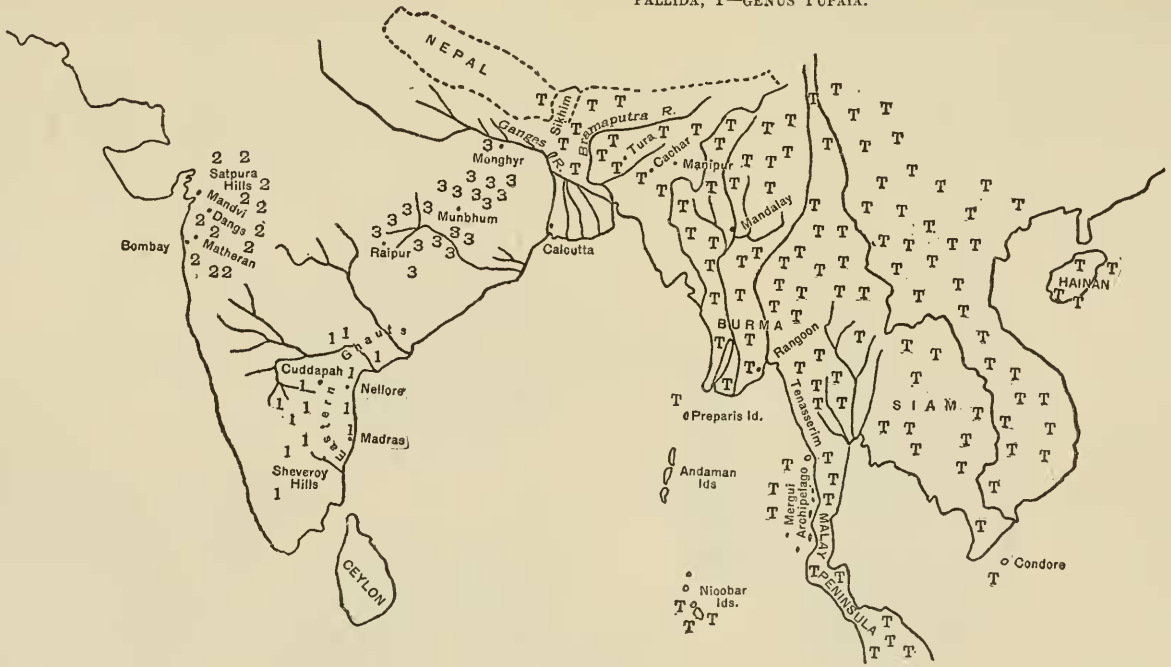
Measurements.—Type: Head and body (from dried skin), 185 ± mm.; tail, from dried skin, 165 ±; hind foot, 41; zygomatic width, 21; width of braincase, 17; maxillary toothrow, 15. For measurement of a second specimen see table, page 126.

Remarks.—Several specimens are recorded by Anderson in the Indian Museum from Monghyr or near there. They are probably examples of this species. The Monghyr specimens bring the range of *Anathana* very close to that of *Tupaia chinensis*, to the northeast of the Ganges Valley.

Specimens examined.—Two, the type and one from Raipur.

[1] Proc. Asiat. Soc. Bengal, 1874, p. 95.

MAP SHOWING THE DISTRIBUTION OF THE GENUS ANTHANA, CONTRASTED WITH THE DISTRIBUTION OF TUPAIA ON THE ASIATIC CONTINENT. 1—ANATHANA ELLIOTI; 2—A. WROUGHTONI; 3—A. PALLIDA; T—GENUS TUPAIA.



Measurements of the genus Anathana.

Name.	Locality.	Number.	Sex.	Molar teeth worn.	Head and body.	Tail.	Hind foot.	Condylo-basal length.	Zygomatic width.	Width of brain case.	Maxillary tooth row.	Number of mammæ.
					mm.	*mm.*	*mm*	*mm*	*mm*	*mm*	*mm*	
A. ellioti	Eastern Ghats, near Cuddapah.	50.1.21.5[1]	Male		180±	180±	40	....	....	....	....	....
Do	....do	50.1.21.6	Female	Much	.....	.....	40	42	22.5	17.5	16	....
Do	....do	50.1.21.7	.....	None	155±	150±	40	....	....	....	....	....
Do	....do	50.8.21.16[2]	.....	Moderately	.....	.....	.....	.....	22.5	18.5	15.5	....
Do	Cuddapah, Madras	81.3.3.13	Male[4]	Adult	160	190	44	....	....	....	....	....
Do	....do	81.3.3.23[3]	Female	....do	180	185	44	....	....	....	....	[5]3–3
Do	....do	Genoa[3]	Male[4]	....do	180	185	45	....	....	....	....	....
Do	Sheveroy Hills	91.10.7.49	Male	Much	.....	.....	.....	42	21.5	18.5	15	....
A. wroughtoni	Mandvi	96.11.7.1[1]	Female	Slightly	177	187	44	42	22.5	18	15	....
Do	Dangs	96.11.7.2	Male	....do	165	195	45	42.5	23	18	15	....
Do	Matheran	73.7.22.5	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
A. pallida	Munbhum	66.12.28.2[1]	Female	Slightly	185±	165±	41	....	21	17	15	....
Do	Raipur	85.8.1.97	.....	None[6]	180±	.....	41	....	....	....	14.5	....

[1] Type.
[2] Skull only.
[3] Preserved in alcohol.
[4] Genitalia well developed.
[5] One inguinal, one axillary, one ventral nearer the inguinal one.
[6] *pm* [4] just appearing.

Genus DENDROGALE Gray.

Type.—Hylogalea murina Schlegel and Müller.[1]

Diagnostic characters.—A small member of the family Tupaiidæ with a skull closely resembling that of *Tupaia*, but fenestra in zygoma reduced to a minute foramen; externally characterized by a close-haired rounded tail and by absence of shoulder stripe, and usually by presence of conspicuous face markings. Mammæ probably, 1–1 = 2.

External characters.—Dendrogale is one of the smallest members of the family; its head and body measurements are about the same as those of *Ptilocercus;* its tail is decidedly shorter. It is the only small member of the family with a round, uniformly close-haired tail. *Urogale* has a somewhat similar tail, but is one of the largest members of the family and has a much lengthened snout. The hairs of the tail are comparatively short and appressed, producing a small, inconspicuous terminal pencil. The base of tail is clothed with relatively long hairs, like those of the adjacent parts of body, but they rapidly diminish in size to become the short appressed form. The naked area of the nose is cut squarely across as in *Tupaia.* The fifth digit on the hind foot is relatively longer than it is in *Tupaia* and the first relatively smaller. The ears are relatively larger than they are in *Tupaia,* due to increase in size of upper and posterior portions; they are also better haired. In the genus *Anathana,* which also has larger ears than *Tupaia,* the increase in size takes place in the lower

[1] Verh. Nat. Gesch. Nederl. Overz. Bezitt., 1843, p. 160.

portion. Some members of the genus have conspicuous face markings, caused by a dark streak extending from half way between nostril and eye through the eye to the ear, and a lighter stripe above and one below this line. In the dark species *Dendrogale melanura* these markings are only barely traceable. Similar face markings are also faintly indicated in *Anathana*. The shoulder stripe present (sometimes almost obsolete in *Tupaia*) in all the other members of the family except *Ptilocercus* is absent in *Dendrogale*. There is probably only only one pair of mammæ and they are inguinal.

Cranial characters.—The skull of *Dendrogale* is in general proportioned as in *Tupaia*. The only very striking difference is the reduction of the zygomatic fenestra to a small foramen. In the comparatively few specimens that I have examined the skull, in addition to being generally small, has a more rounded brain case, is less angular, has less conspicuous temporal ridges as compared with *Tupaia*. Unfortunately none of the specimens have been old adults. The skull figured by Schlegel and Müller[1] is quite as angular as the majority of *Tupaia* skulls. See below under type-specimens of *Dendrogale murina*, page 130.

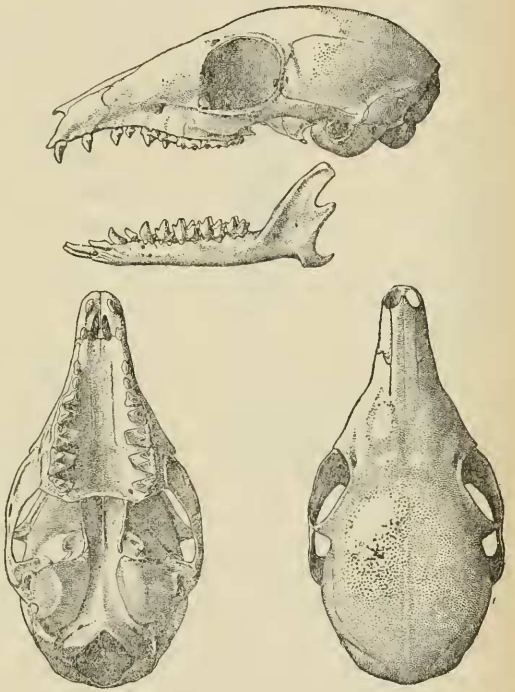


FIG. 8.—DENDROGALE MELANURA MELANURA, TYPE × 1½. REG. NO. 92. 2. 7. 11, BRITISH MUSEUM, 5,000 FEET ON MOUNT DULIT, NORTHERN BORNEO.

Dental characters.—The teeth of *Dendrogale* are very similar to those of *Tupaia*. The hypocones of the upper molars are considerably reduced, so that practically none are found on the second and third molars. The anterior teeth, i^1, i^2, c^1, c_1, pm_2, pm_3, are more trenchant in character than they are in *Tupaia*, especially seen in the second upper incisor. The dental characters, however, are relatively unimportant and would not be of themselves sufficient to warrant the generic distinctness of *Dendrogale*, but in conjunction with other characters serve to emphasize the validity of the genus.

[1] Verh. Nat. Gesch. Nederl. Overz. Bezitt., 1843, pl. 27, figs. 17–18.

Geographic distribution.—So far as known *Dendrogale* occurs only in Borneo and southeastern French Indo-China. As members of the genus *Dendrogale* are very rare in collections, it is not at all probable that this represents the extent of its distribution. When explorations of the Malayan region are more complete it will probably be found elsewhere, particularly Sumatra, where the rare genus *Ptilocercus* was unknown for some time. See also remarks under *Dendrogale murina* below, page 131. See A, B, M, N, on map on page 133.

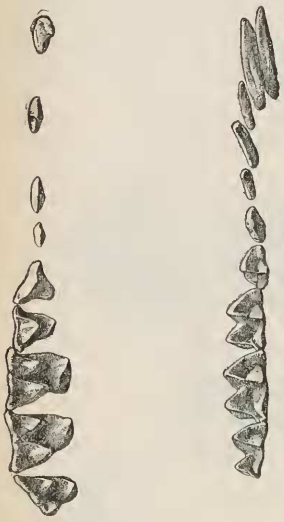


FIG. 9.—UPPER AND LOWER TOOTHROWS OF DENDROGALE MELANURA MELANURA, × 3¼. REG. NO. 92. 2. 7. 10, BRITISH MUSEUM, 5,000 FEET ON MOUNT DULIT, NORTHERN BORNEO.

Number of forms.—Four named species or subspecies are recognized. They fall into two very distinct almost subgeneric groups:

1. *Murina* group; color light, face-markings present, claws small, plate 5.
   Dendrogale murina, Pontianak, Borneo, page 129.
   Dendrogale frenata, Cambodia, page 128.
2. *Melanura* group, color dark, face-markings absent, claws long.
   Dendrogale melanura melanura, Mount Dulit, Borneo, page 132.
   Dendrogale melanura baluensis, Mount Kina Balu, Borneo, page 132.

KEY TO THE SPECIES OF DENDROGALE.

Color light, face marking conspicuous, claws small, 1.5–2 mm.
- Hind foot more than 25 mm. (27–29) (southeastern French Indo-China) ..... *D. frenata*, p. 128.
- Hind foot less than 25 mm. (22) (Borneo) ..... *D. murina*, p. 129.

Color very dark brown, face markings absent, claws large, 4 mm.
- Upper parts darker, base of tail and rump distinctly rusty, tail and feet darker (Borneo; Mount Dulit) ..... *D. melanura melanura*, p. 132.
- Upper parts lighter, base of tail and rump less rusty, tail and feet lighter (Borneo; Mount Kina Balu) ..... *D. melanura baluensis*, p. 132.

DENDROGALE FRENATA (Gray).

1860. *Tupaia frenata* GRAY, Ann. Mag. Nat. Hist., ser. 3, vol. 6, p. 217, August, 1860.

1879. *Dendrogale frenata*, ANDERSON, Zool. Res. West. Yunnan, 1879, p. 110.

Type-locality.—Cambodia.

Type-specimen.—In British Museum, Reg. No. 60.8.28.11, skin and skull, collected in Cambodia by M. Mouhot; skin is mounted and in fair condition; skull considerably damaged between the palate and foramen magnum, not fully adult, dpm^3 still in place and pm^3 just appearing beneath it.

Geographic distribution.—Cambodia and Anam. See A on map on page 133.

Diagnosis.—Color light, face markings conspicuous, claws small and blunt, 1.5–2 mm.; hind foot 25 mm. or over.

Color.—Type, with rather soft and close fur, upper parts of neck, body, and base of tail a fine grizzle of brownish black and ochraceous, (the ochraceous inclining to buff anteriorly and to tawny posteriorly) the two colors about equally mixed; outer side of legs similar to adjacent parts of body; upper parts of head a fine grizzle of blackish and buff, the former in excess; underparts and inner side of legs pale buffy; side of head with a blackish line beginning at base of whiskers, gradually becoming wider, and running through eye to ear, bordered above by a buffy line and below by a similar line; tail above similar to back, but darker for distal three-fourths, below, a dark line in the middle, bordered by an ochraceous line, and on the extreme outer edge by the color of the tail above. Plate 5.

A paratype is essentially like the type, but is more tawny on the rump and base of tail. Reg. No. 7.1.1.1, a topotype collected in 1861 (?), is ochraceous buff on the underparts instead of pale buffy. Two modern skins, Reg. Nos. 6.11.6.5 and 6.11.6.6, from Nhatrang, Anam, are in general similar to the original series, but are slightly more yellowish anteriorly, and one of them, 6.11.6.5, has rather long soft fur like that of *Dendrogale melanura*.

Skull and teeth.—These are practically indistinguishable from those of other species of *Dendrogale* that I have examined; the brain case is not quite so inflated or arched as that of *D. melanura*.

Measurements.—Type: Head and body (from mounted skin), 135 mm.; tail (from mounted skin), 95; hind foot, 27; condylobasal length, 31; zygomatic width, 17; width of brain case, 15.5; maxillary tooth row, 12. For individual measurements, see table, page 134.

Specimens examined.—Four from Cambodia and two from near Nhatrang, Anam.

DENDROGALE MURINA (Schlegel and Müller).

1843. *Hylogalea murina* SCHLEGEL and MÜLLER, Verh. Nat. Gesch. Nederl. Overz. Bezitt., p. 167, pl. 26, fig. 5; pl. 27, figs. 17 and 18; entire animal in colors, and lateral and dorsal views of skull both apparently very good.

1879. *Dendrogale murina*, ANDERSON, Zool. Res. West. Yunnan, p. 110, pl. VII, figs. 18 and 19, skull.

1888. *Glipora murina*, JENTINK, Mus. Hist. Nat. Pays-Bas, Cat. Syst. Mamm., vol. 12, 1888, p. 118. Publication of Diard's manuscript name under the heading *Typaja murina*.

Type-locality.—Pontianak, western Borneo.

Type-specimen.[1]—In the Leyden Museum, mounted skin and skull; male, skin somewhat faded and dust stained; skull broken away

[1] I have not seen this specimen, which appears to be the only representative of the species known. My information regarding the specimen and species is obtained from notes made by Mr. G. S. Miller, jr., in the Leyden Museum in 1905.

behind orbits but perfect in front and with complete lower jaw. (The skull figured by Schlegel and Müller is perfect. It is possible that the posterior portion of their figure was made up by analogy from a *Tupaia* skull. Anderson figures a perfect skull but I suspect he copied Schlegel and Müller's figures, transposing their lateral view from right to left, and apparently the dorsal view also in the process of lithographing. The skull was very incomplete in 1888 according to Jentink.[1] (See Plate 5.)

Geographic distribution.—Known only from the type-locality, but undoubtedly occuring elsewhere in Borneo. See B on map on page 133.

Diagnosis.—Differs from *Dendrogale frenata* mainly in the smaller size of hind feet, and if the illustrations of the skull are accurate, in having much narrower nasals; and tail above different in color from body.

Color.[2]—"Underparts and under surface of tail dull light ochraceous-buff. Upperparts the same but much darkened dorsally by admixture of a dark broccoli brown. Tail an indefinite dark tawny brown above, line of demarkation on tail sharp, but colors not forming any strong contrast. Median line of tail below not different from rest of its lower surface. At middle the hairs alongside of tail are 5 mm. in length, at tip they are 10 mm. Outer surface of legs slightly less yellowish than sides of body. Feet dark. A faint dark shade passes from muzzle through eye to ear; above, it is bordered by a light area 3 mm. wide behind eye, less distinct in front. Below, the light border may be detected behind eye, but not in front."

Skull and teeth.—If the illustrations are to be relied on the skull of *Dendrogale murina* would appear to be much more angular and with better developed temporal ridges than that of *D. frenata*, and to have much slenderer nasals. The teeth in the two species are probably essentially the same; their measurements agree almost exactly.

Measurements.[2]—"Head and body, 115 mm.; tail, 110; hind foot (distorted), 22 (all from mounted specimen); least distance from orbit to tip of premaxillary 13.6 (13.8);[3] least interorbital breadth 9.8 (10); zygomatic breadth (approximately) 17; mandible, 22 (22); maxillary tooth row (entire, including incisors) 17.4." The maxillary tooth row, including incisors, in the illustration is the same or nearly so, and the measurement of the maxillary tooth row without the incisors in the illustration is 12, the same as the maxillary tooth row of *D. frenata*.

Remarks.—It is unfortunate that direct comparisons of *Dendrogale frenata* and *D. murina* have not been made. The two animals

[1] Mus. Hist. Nat. Pays-Bas Cat. Osteol. Mamm., vol. 12, 1888.

[2] Quoted from manuscript notes made by Mr. G. S. Miller, jr.

[3] Measurements in parentheses are those made by Mr. Miller or the type of *T. frenata*.

appear to be very similar. Their most apparent differences have been pointed out above, and from what is known of the fauna in general of Borneo and Anam, the two animals would certainly be expected to be different; in fact much more different than they appear to be. Both species have probably some peculiarity of habit making them difficult to secure. So far as I know only one specimen of *Dendrogale murina* has been collected. It is curious that no subsequent specimen has been obtained since the original. As the geographic distribution of the genus is so peculiar and so totally unlike that of any of the related genera or in fact of most genera of mammals there is just a possibility that *Dendrogale murina* is an example of *D. frenata* wrongly labeled as coming from Pontianak, Borneo. Dr. W. L. Abbott, with much careful collecting in the region of the type-locality, failed to secure it.

Specimens examined.—None.

DENDROGALE MELANURA (Thomas).

(Synonymy, type-specimens, etc., under the subspecies.)

Geographic distribution.—High mountains of northern Borneo. No specimens recorded below 3,000 feet. See M and N on map on page 133.

Diagnosis.—Distinguished from the other members of the genus by its dark-brown color, lack of face markings, and by its large sharp claws, about 4 mm. in length, fur long and soft; mammæ 1–1=2.

Color.—Upper parts of head, neck, and body a fine grizzle of blackish and ochaceous buff, anteriorly, and cinnamon rufous, posteriorly and at base of tail, the darker color in excess; bases of hairs slate black; outerside of legs similar to adjacent parts of body; feet dark brownish; underparts ochraceous with slate bases of hairs showing through; inner side of legs similar to adjacent underparts; immediately above and below eye, a short ochraceous line, both together appearing like an eye ring with indistinct corners; tail a mixture of black or blackish, and cinnamon rufous with the black very prominent when viewed from above; tail, seen below, with the short appressed hairs in middle line black or brownish black, bordered on either side by other short hairs with more or less evident cinnamon rufous bases.

Skull and teeth.—These are practically indistinguishable from those of *Dendrogale frenata*, except that the braincase is slightly more inflated and arched.

Subspecies.—Two races of *Dendrogale melanura* are known, one from Mount Dulit and the other from Mount Kina Balu, neither of them very highly differentiated.

DENDROGALE MELANURA MELANURA (Thomas).

1892. *Tupaia melanura* THOMAS, Ann. Mag. Nat. Hist., ser. 6, vol. 9, p. 251, March, 1892.

1892. *Tupaia melanura*, THOMAS, Proc. Zool. Soc. London, 1892, p. 224, pl. 19, figs. 4, 5, skull.

Type-locality.—Mount Dulit, northern Borneo, 5,000 feet altitude.

Type-specimen.—In British Museum, Reg. No. 92.2.7.10, skin and skull of adult female, collected at 5,000 feet on Mount Dulit, Borneo, October, 1891, by Mr. Charles Hose; skin well preserved, but somewhat damaged about the head; skull in fair condition, slightly damaged in supraoccipital region. (See figures 8 and 9 on pages 127 and 128.)

Geographic distribution.—Known only from Mount Dulit, Borneo. See M on map on page 133.

Diagnosis.—Upper parts of head and body dark, due to a deeper shade of the ochraceous buff element of the color; base of tail and rump with the cinnamon rufous element of the color more conspicuous, so that that part of the animal appears distinctly rusty; feet and especially the tail darker, the latter with more black and the ochraceous on the underside less in evidence.

Skull and teeth.—These are without distinguishing characteristics.

Measurements.—See table, page 134.

Specimens examined.—Three from Mount Dulit.

Remarks.—Hose, in Mammals of Borneo (p. 33, 1893), remarks of this animal: "The type of this pretty little treeshrew was obtained by me on the top of Mount Dulit at 5,000 ft., living amongst the moss-covered stunted jungle, and it is apparently a true mountain species, as I have since obtained other specimens, none of which were found below 3,000 ft."

DENDROGALE MELANURA BALUENSIS, new subspecies.

Type-locality.—Mount Kina Balu, northeastern Borneo.

Type-specimen.—In British Museum, Reg. No. 92.9.6.3, skin and skull of adult female, collected on Mount Kina Balu, Borneo, by Mr. A. Everett; skin in good condition; skull imperfect.

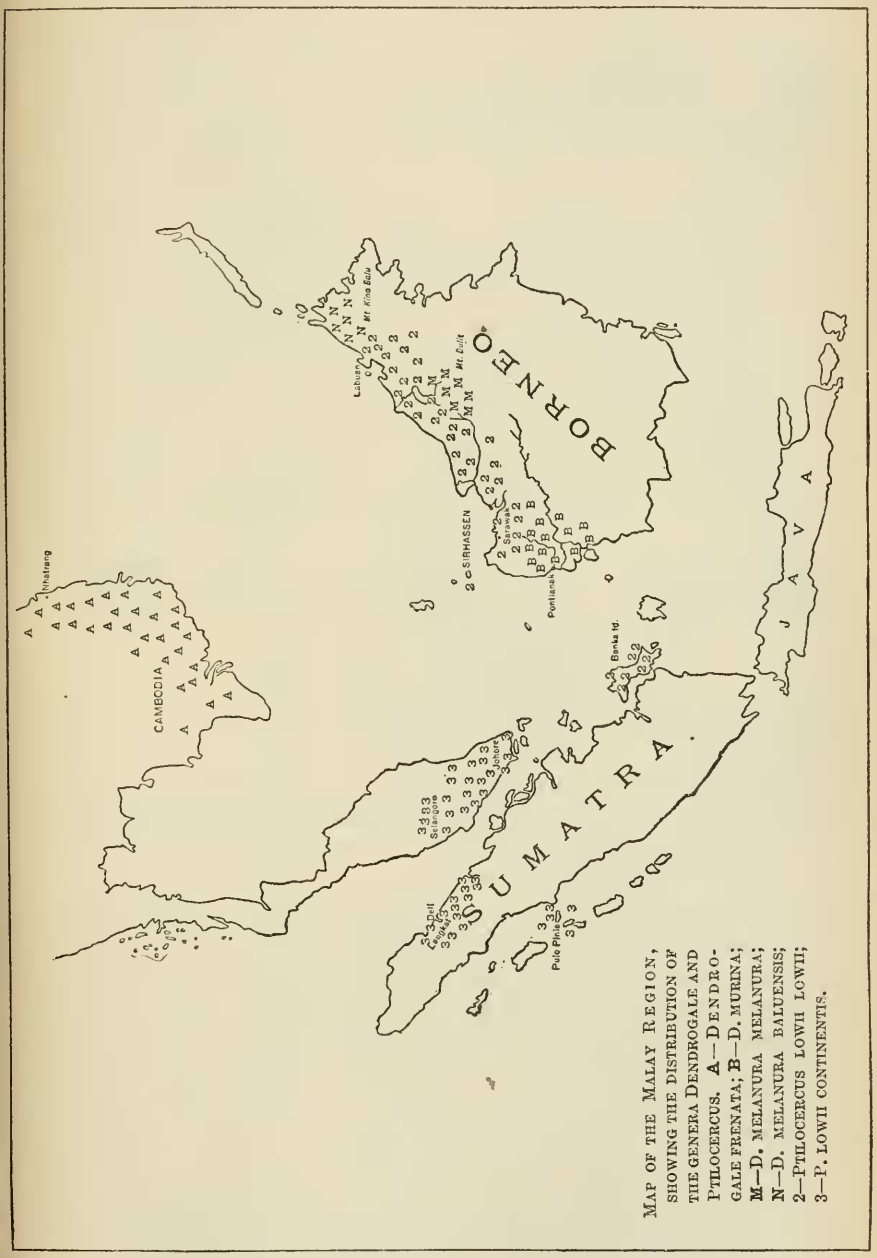
Geographic distribution.—Known only from the type locality. See N on map on page 133.

Diagnosis.—Distinguished from *Dendrogale melanura melanura* by having the ochraceous buff of the anterior upper parts lighter and more in evidence, and the cinnamon rufous posteriorly lighter, feet light brownish; underparts ochraceous buff, rather than ochraceous: tail with black hairs less in evidence and with the appearance of a narrow line of ochraceous on either side of the middle line.

Skull and teeth.—These show no distinguishing characteristics.

Measurements.—See table, page 134.

Specimens examined.—Three, all from Mount Kina Balu.



MAP OF THE MALAY REGION, SHOWING THE DISTRIBUTION OF THE GENERA DENDROGALE AND PTILOCERCUS. A—DENDROGALE FRENATA; B—D. MURINA; M—D. MELANURA MELANURA; N—D. MELANURA BALUENSIS; 2—PTILOCERCUS LOWII LOWII; 3—P. LOWII CONTINENTIS.

Measurements of specimens of the genus Dendrogale.

Name.	Locality.	Number.	Sex.	Molar teeth worn.	Head and body.	Tail.	Hind foot.	Condylo-basal length.	Zygomatic width.	Width of brain case.	Maxillary tooth row.	Number of mammæ.
					mm	*mm*	*mm*	*mm*	*mm*	*mm*	*mm*	
D. frenata	Cambodia	60.8.2.12[1]			125	....	27	....	....	....	....	....
Do	do	60.8.28.11[2]		None[3]	135±	95±	27	31	17	15.5	12	....
Do	Chautabean Cambodia.	7.1.1.2		Slightly	120±	100±	27	....	....	15	11	....
Do	do	7.1.1.1		None[4]	125±	95±	27	30.5	16	15	11.5	....
Do	Buli near Nhatrang Anam.	6.11.6.5		do[5]	120±	110±	28	32.5	17	15.5	12	....
Do	do	6.11.6.6		do[6]	140±	110±	29	32.5	17	15	12	....
D. murina[7]	Pontianak, Borneo.	Leyden[8]	Male		115±	110±	22±	....	17	....	12±	...
D. melanura melanura.	Mount Dulit, 5,000 feet, Borneo.	92.2.7.10[8]	Female.	Slightly	130±	130±	32	32.5	17.5	15	12	1-1
Do	Mount Dulit, 3,000 feet.	99.12.9.12	Male	Moderately	....	....	31±	....	....	....	12	....
Do	Mount Dulit, 5,000 feet.	Paris, 2231		(9)	140±	135±	30±	....	....	....	....	....
D. melanura baluensis.	Mount Kina Balu, Borneo.	92.9.6.38	Female.	Slightly	150±	125±	33	....	17	15.5	11.5	1-1
Do	do	93.4.1.39[9]	Male	Adult	115	115	30	....	....	....	....	....
Do	do	Berlin, 11055		Moderately	130±	130±	30	....	....	....	11.5	....

[1] Mounted.
[2] Type, mounted.
[3] di^1 and dpm^3 still in place.
[4] dpm^4 still in place.
[5] Permanent canines appearing.
[6] i^2 appearing.
[7] From notes made by Mr. Miller in Leyden, 1905.
[8] Type.
[9] Preserved in alcohol.

TANA, new genus.

Type.—*Tupaia tana* Raffles, Trans. Linn. Soc. London, vol. 13, p. 257, May, 1821.

Diagnostic characters.—A member of the mammalian family Tupaiidæ, similar to typical *Tupaia*, differing in the possession of a much attenuated snout and rostrum and a recession backward on top of nose of the naked hairless portion.

External characters.—The external form of *Tana* is essentially like that of *Tupaia* with the exception of the elongated snout and the backward extension of the naked area of the nose on top into the haired area instead of being cut square across as in *Tupaia*. All the members of the genus are characterized by the possession of a middorsal stripe of varying length and width. This, however, is not diagnostic as one member of the genus *Tupaia*, *T. picta*, has a well-marked dorsal stripe, and *Tupaia montana* frequently has a broad, dark dorsal area. The squirrel-like appearance of treeshrews in general is still carried out by the genus *Tana*, which may be compared with the long-snouted genus of squirrels, *Rhinosciurus* Gray.[1] The mammæ are 2–2 in number. (See figure 2, p. 31, plate 6, figs. 1 and 2.)

[1] List Spec. Mamm. Brit. Mus., 1843, pp. xxv, 195.

Cranial characters.—Rostrum considerably elongated and attenuated, so that the distance from the lachrymal notch to the end of premaxilla is equal to the distance from the notch to the occipital condyles. The length of the rostrum is mainly brought about by a lengthening of the premaxillary and nasal bones and not by any appreciable increase in length of the maxilla. Fenestra in zygoma large and conspicuous, elongated oval in shape.

Dental characters.—The teeth of *Tana* do not differ in form or number from those of *Tupaia*. Owing to the elongation of the rostrum the anterior teeth are somewhat differently spaced. Thus the lower canine stands closer to the last lower incisor than it does to the adjacent premolar, while in *Tupaia* it stands midway between the two teeth. The combined length of the three upper molars is about one-third the length of the entire upper tooth row in *Tupaia*, but in *Tana* it is distinctly less than one-third the length of entire tooth row.

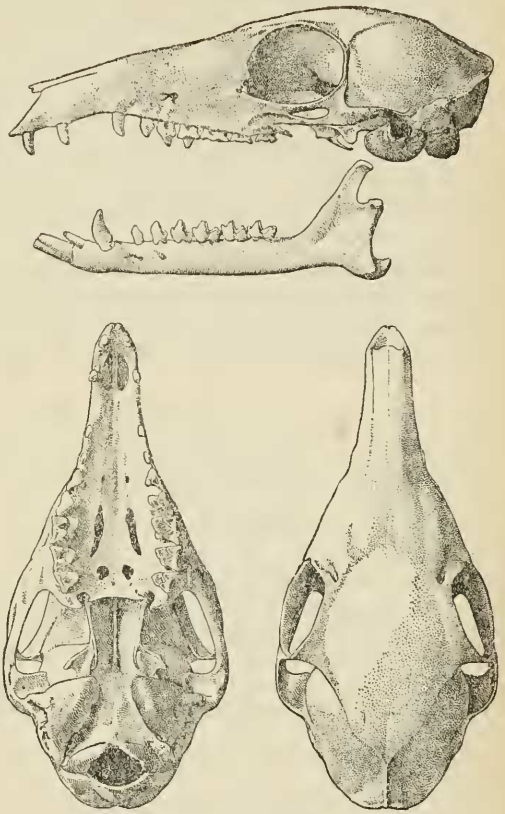


FIG. 10.—TANA TANA BESARA, TYPE × 1. CAT. NO. 142247, U.S.N.M., KAPUAS RIVER, BORNEO.

FIG. 11.—UPPER AND LOWER TOOTH-ROWS OF TANA TANA BESARA, TYPE × 2. CAT. NO. 142247, U.S. N.M. KAPUAS RIVER, BORNEO.

The absence of a cecum may be one of the generic characters. See page 14.

Geographic distribution.—The genus *Tana*, so far as known, is confined to the land masses of Borneo and Sumatra and certain of the small adjacent islands. Unlike *Tupaia* it is not

found in Java, the Malay Peninsula, or elsewhere on the Asiatic mainland. See map on page 143.

1. *Dorsalis* group; delicate build, short claws, pl. 6, fig. 2.
   Tana dorsalis, Borneo, pl. 11, fig. 1, page 152.
2. *Tana* group; heavy build, stout claws, pl. 6, fig. 1.
   Tana tana tana, Sumatra, southern Borneo, pl. 11, fig. 4, page 139.
   Tana tana besara, Kapuas River, Borneo, pl. 11, fig. 8, page 141.
   Tana tana utara, northern Borneo, page 141.
   Tana tana sirhassenensis, Sirhassen Island, pl. 11, fig. 3, page 142.
   Tana tana bunoæ, Tambelan Islands, pl. 11, fig. 5, page 144.
   Tana tana tuancus, Banjak Islands, page 145.
   Tana lingæ, Linga Island, pl. 11, fig. 2, page 145.
   Tana cervicalis cervicalis, Tana Bala, Batu Islands, page 147.
   Tana cervicalis masæ, Tana Masa, Batu Islands, page 148.
   Tana chrysura, Borneo, opposite Labuan, page 149.
   Tana paitana, northeastern Borneo, Banguey Island, page 150.

KEY TO THE SPECIES OF TANA.

Size small, a narrow dorsal stripe extending the entire length of the back; claws small and short; hairs of tail of medium length not strongly distichous. *Dorsalis* group.
Borneo, *T. dorsalis*, p. 152.

Size large, a narrow dorsal stripe on anterior half of back, and bordered by a light area different in color from rest of back; claws large and well developed; hairs of tail long and strongly distichous ..... *Tana* group.

Tail, buff, very different in color from rest of body. North Borneo, *T. chrysura*, p. 149.

Tail, reddish brown, not noticeably different in color from rest of body.

Shoulder stripe bordered above and below by the light or grayish or buffy color of the anterior back..... Northeast Borneo, *T. paitana*, p. 150.

Shoulder stripe bordered above and below by the reddish brown color of the sides of body.

Size small; hind foot, 40 mm.; tail, 135; rostrum very narrow and slender.
Linga Island, *T. lingæ*, p. 145.

Size medium or large, hind foot over 45 mm. and tail over 150; rostrum not so narrow and slender.

Reddish colors bright, and back with a very large well marked brilliant black area..... *T. cervicalis*, p. 147.

Light areas beside the dorsal stripe, cream buff slightly mixed with black.
Tana Bala Island, *T. cervicalis cervicalis*, p. 147.

Light areas beside the dorsal stripe tawny ochraceous slightly mixed with black..... Tana Masa Island, *T. cervicalis masæ*, p. 148.

Reddish color usually not so bright, generally rather dull, without a large wide brilliant black area on back, the lower back, however, is always darker than rest of upper parts and sometimes black, but the black color is never widely spread ..... *T. tana*, p. 137.

General coloration decidedly dull.

Size very large; hind foot 53 mm.; condylo-basal length 59.
Western Borneo, *T. tana besara*, p. 141.

Size medium; hind foot about 48 mm.; condylo-basal length about 55; tail about 175..... Sumatra, southern Borneo, *T. tana tana*, p. 139.

Size small; hind foot about 44; condylo-basal length about 53; tail about 155..... Tambelan Islands, *T. tana bunoæ*, p. 144.

General coloration relatively bright.

Light areas beside the dorsal stripe very light and grayish; condylo-basal length 53 mm. or more .... Northern Borneo, *T. tana utara*, p. 141.

Light areas beside the dorsal stripe duller and darker, more ochraceous; condylo-basal length 53 mm. or less.

Size slightly smaller; reddish color duller; underside of tail lighter; shoulder stripe buff, well marked.

Sirhassen Island, *T. tana sirhassenensis*, p. 142.

Size slightly larger; reddish color brighter; underside of tail darker; shoulder stripe ochraceous; rather poorly developed.

Tuangku Island, *T. tana tuancus*, p. 145.

TANA TANA (Raffles).

(Synonymy, type-specimens, etc., under the subspecies.)

Geographic distribution.—Borneo, Sumatra, and adjacent small islands. See Nos. 3, 4, 5, 6, 7, and 8 on map on page 143.

Diagnosis.—General color of sides and shoulder region hazel; lower back with an area distinctly darker than rest of upper parts, but sometimes presenting a distinct but rather small black patch; shoulder stripe bordered above and below by the hazel of the sides; size large.

Color.—Sides of body and shoulder region and outer side of legs, hazel, somewhat brighter than Ridgway's, and more or less lined with blackish annulations of the hairs, especially posteriorly, where the darker color gradually spreads upward to concentrate itself in a dark area on the lower back, which sometimes appears as a small distinct black patch, dorsal stripe beginning faintly at occiput but becoming very distinct over shoulders, blackish reddish brown, and gradually losing itself in with the dark area of lower back; dorsal stripe bordered on either side by a light area sometimes poorly and sometimes well defined, made up of a rather coarse grizzling of cream buff (when light area is well marked) or ochraceous buff (when light area is less conspicuous) and blackish brown; top and sides of head and neck generally like the light areas on each side of dorsal stripe, but rather lighter and the grizzling finer; underparts, including inner side of legs, orange rufous to ferruginous; feet generally a dull and often darker extension of the color of the outer side of legs; tail above, bright hazel or ferruginous, more or less, and irregularly suffused with blackish; underside of tail similar to upper side for its outer half, but the inner portion orange rufous; shoulder stripe well marked and of the same general colors as light area on each side of dorsal stripe, but lighter in tint.

Skull and teeth.—There are no apparent characters by which the skull and teeth of *Tana tana* may be distinguished from other species of equal size.

Measurements.—Usual measurements of adults: Head and body, 200–230 mm.; tail, 160–190; hind foot, 45–50; condylobasal length, 53–60; zygomatic width, 25–28; width of brain case, 20–22; maxillary tooth row, 20–22.

Subspecies.—The following geographic forms may be recognized: *Tana tana tana*, Sumatra, southern Borneo; *T. t. utara*, northern

Borneo; *T. t. besara*, lower Kapuas River, Borneo; *T. t. sirhassenensis*, Sirhassen, Natuna Islands; *T. t. bunoæ*, Tambelan Islands, and *T. t. tuancus*, Banjak Islands.

Remarks.—*Tana tana* is distinguished from *T. cervicalis* by its duller and less brilliant colors and less conspicuous black area on lower back, from *T. paitana* by having the shoulder stripe bordered above and below by general color of sides, and from the Linga species by its greater size. The material for making a comparison of the Sumatran and Bornean tanas is not entirely satisfactory. Good Sumatran specimens are rather scarce, as an examination of the list of specimens on page 140 will show. There is not one good fully adult modern study skin of *Tana tana tana* from the island that is its type-locality. Probably the best material is in the United States National Museum (represented by two specimens from Deli almost as far from the exact type-locality, Bencoolen, as one can find) and in the Philadelphia Academy of Natural Sciences. One of the National Museum specimens is in alcohol, the other a skin made from one in alcohol. The colors of both of them are not beyond question, although apparently unchanged. Their underparts are distinctly darker than the underparts of Bornean examples. Most of the Philadelphia skins are immature, and none shows any tangible character by which to distinguish them from Bornean skins. The skulls and teeth show no distinguishing features between the Bornean and Sumatran specimens. For the present at least the same subspecies of *Tana tana* must be regarded as occurring in southern Borneo and Sumatra. In Paris, Berlin, and London are a few specimens of *Tana tana* simply labeled "Borneo." I have not included them in the lists and measurements of specimens, and have made no attempt to assign them to any particular subspecies. Many of them are old and mounted. A fair number of specimens of *Tana tana* exist in museums from definite localities in Borneo, and while they show considerable individual variation, yet as a whole they fall into two groups, those from Sarawak being brighter colored and those from southern Borneo duller, with a large member of the dull form on the lower Kapuas River. The brighter-colored specimens seem to be associated with the mountains while all those from southern Borneo have been taken in the lowlands. Future explorations may show that on Borneo the bright colored form is an inhabitant of the higher regions of that island and the duller form are inhabitants of the lowlands of the coastal region. The present division into northern and southern races may simply be owing to the fact that the lowlands of southern Borneo have been explored, mainly by Abbott and by Shortridge; while in the north Hose worked in the higher altitudes. Our knowledge of this species on both Sumatra and Borneo is very elementary at present. On Sirhassen of the Natuna Islands is a well-marked geographic race closely related to the lowland Bornean form.

TANA TANA TANA (Raffles).

1821. *Tupaia tana* RAFFLES, Trans. Linn. Soc. London, vol. 13, p. 257, May, 1821.
1825. [*Cladobates*] *tana*, CUVIER, Dents Mamm., 1825, p. 61.
1840. *Erinaceus* (*Glisorex*) *tana*, BLAINVILLE, Ostéogr. Mamm., vol. 1, p. 112, pl. 6, fig. 1.
1841. *Cladobates speciosus* WAGNER, Schreber's Säugthiere, Supplementband. pt. 2, p. 43, 1841. (Type-locality, Borneo.)
1843. *Hylogalea tana*, SCHLEGEL AND MÜLLER, Verh. Nat. Gesch. Nederl. Overz. Bezitt., p. 161, pl. 26, fig. 2; pl. 27, figs. 1–6, 1843.
1879. *Tupaia tana*, ANDERSON, Zool. Res. West. Yunnan, 1879, p. 136, pl. 7, figs. 1 and 2.

Type-locality.—Sumatra, probably Bencoolen.

Type-specimen.—In British Museum, Reg. No. 95.3.21.4, collected by Sir Stamford Raffles in Sumatra, probably at Bencoolen, a badly damaged skull (no skin can be found), nearly everything posterior to palate lacking, as well as right premaxilla, several of the maxillary teeth lost; mandible perfect; not fully adult, the permanent upper incisors just appearing.

Geographic distribution.—Sumatra, southern Borneo, in the low country. See No. 5 on map on page 143.

Diagnosis.—A relatively dark and dull member of the species, especially in region of sides and shoulders, light area on either side of dorsal stripe a mixture of ochraceous buff and blackish brown, neither color in excess.

Skull and teeth.—Without definite subspecific characters. (Plate 11, fig. 4.)

Measurements.—Usual measurements of adults: Head and body, 200–220 mm.; tail, 160–180; hindfoot, 47–50; condylo-basal length, 54–56; zygomatic width, 25–27; width of braincase, 20–21; maxillary toothrow, 19.5–21.5. For details of measurements see table, page 140.

Remarks.—Two Sumatran specimens of *Tana tana tana* in the United States National Museum differ slightly from the Bornean ones in having the underparts ferruginous instead of orange rufous; but both specimens have been subjected to alcohol and one is still preserved in that fluid. The bullæ of one of them, Cat. No. 174611, are very small in comparison with the bullæ of Bornean skulls, but the latter show marked variation in the size of the bullæ. The skull of the second Sumatran specimen has bullæ equaling in size the smaller bullæ of the Bornean specimens. Specimens from the Lampong District, Sumatra, in the Philadelphia Academy of Natural Sciences, do not show tangible differences from the Bornean specimens.

Wagner's name *speciosus* was applied by him to a specimen in the Erlangen Museum. His description applies more closely to the southern Bornean form than to the brighter colored northern form. Until the distinctness of the Sumatran longnosed treeshrew from the lowland Bornean animal is established, *speciosus* must stand as a synonym of *tana*, but in the event of their distinctness it will be available for the Bornean form. It is rather unfortunate that the exact locality for Wagner's specimen is not known, but as most of the old

collecting in Borneo was done in the southern part, it is probable that it came from southern Borneo, especially as the description seems more applicable to the southern form. Wagner did not have a skin of the Sumatran tana when he applied the name *speciosus*, hence his error of considering the two forms different.

The specimen in the British Museum from Pajo is not typical, and if the characters it presents are constant for the longnosed treeshrews of that region, it represents a distinct form. It is very dark and dull in color and the red element much suppressed. Some of this difference in color may be the result of preservatives. (See remarks under *Tana tana utara*, p. 142.)

The Bornean specimens in the United States National Museum have been previously called *Tupaia speciosa*.[1]

Specimens examined.—From Sumatra 16, and 11 from Borneo. See list of specimens below.

Measurements of Tana tana tana.

Locality.	Number.	Sex.	Molar teeth worn.	Head and body.	Tail.	Hind foot.	Condylo-basal length.	Zygomatic width.	Width of brain case.	Maxillary tooth row.	Number of mammæ.
				mm.	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	
Deli, Sumatra	174611	Male	None [2]	200±	160±	46	55.5	25	20	21	....
Do	174612	Female	Slightly [3]	10	180	48	54	25.5	21	20	2-2
Lampong, South Sumatra.	81.3.15.3	Male	None	.....	.....	47	.....	.....	19.5	19.5	....
Do	81.3.15.4	do	do	.....	.....	47	52±	.....	20	19.5	....
Sumatra	79.7.2.2 [4]	.....	Moderately	.....	.....	50	59	27	20.5	22	....
Sumatra (Raffles)	95.3.21.5	.....	None	.....	.....	(5)	.....	.....	.....	20	....
Do	95.3.21.4 [6]	.....	do [7]	.....	.....	(5)	.....	.....	.....	20.5	....
Sumatra (Higgins)	77.3.4.1 [4]	.....	Moderately	.....	.....	46	53	25	20	20	....
Sumatra, Blalau, 1,700 feet.	82.7.28.6 [3]	Female	Adult	185	160	50	.....	.....	.....	.....	2-2
Sumatra, Pajo	79.6.28.14	Male	Slightly	.....	.....	50	.....	26	21	20.5	....
Sumatra	Berlin, 631	.....	(8)	.....	.....	46	.....	.....	.....	.....	....
Sumatra, Gunong Sugi, under 500 feet.	Phila., 6664	.....	(9)	130±	120±	39	.....	.....	.....	.....	....
Do	Phila., 6662	.....	(9)	145±	130±	39	.....	.....	.....	.....	....
Do	Phila., 6661	.....	(10)	165±	145±	45	.....	.....	.....	.....	....
Do	Phila., 6659	.....	(11)	190±	180	47	.....	.....	.....	.....	....
Do	Phila., 6660	Female	Moderately	200±	160±	47	53	.....	.....	20.5	2-2
Borneo, Sungei Matan.	145574	do	do	220	180	53	56	25.5	20.5	21	2-2
Do	145573	Male	Unworn	207	188	49	53.5	25	21.5	20	....
Borneo, Klumpang Bay.	151885	Female	Moderately	210	180	48	55	26	20±	19.5	2-2
Borneo, Pamukang Bay.	154341	Male	Slightly	210	170	48	54	27	20	19.5	....
Borneo, Pasir River.	154339	do	do	209	175	47	53.5	26	20	19.5	....
Borneo, Balik Papan Bay.	154340	Female	do	210	180	49	55	27	20	20	2-2
Borneo, Martapoera River, Karangintan, 30 feet.	10.4.5.74	Male	do	205	180	46	52	25	19.5	19.5	....
Do	10.4.5.75	Female	Moderately	210	190	47	51.5	26.5	20	19.5	2-2
Boentok, Barito River.	10.4.5.73	do	Slightly	190	185	48	.....	25	20	19	2-2
Southwest Borneo	Berlin, $\frac{6332}{1333}$ [8]	.....	do	.....	.....	45±	56±	27	21	22.5	....
Southeast Borneo	Berlin, 6144 [8]	Male	do	230±	150±	45±	56	27	20	22	....

[1] See Proc. U. S. Nat. Mus., vol. 40, p. 121, Apr. 25, 1911.
[2] i^1 just appearing.
[3] Preserved in alcohol.
[4] Skeleton; no skin.
[5] Skull only; no skin.
[6] Type.
[7] Permanent incisions halfway through.
[8] Mounted.
[9] About one-half grown.
[10] About three-fourths grown.
[11] Adult, or nearly so.

TANA TANA BESARA, new subspecies.

Type-locality.—Opposite Pulo Jambu, below Tyan, on north or right bank of Kapuas River, western Borneo.[1]

Type-specimen.—In United States National Museum, Cat. No. 142247, skin and skull of adult male, collected opposite Pulo Jambu, Kapuas River, on the north or right bank of the river, September 17, 1905, by Dr. W. L. Abbott; original number, 4458; skin and skull in good condition. (See figures 10 and 11 on page 135.)

Geographic distribution.—Known only from the type-locality, but probably found throughout the low swampy area of western Borneo, north of the Kapuas River.[1] See No. 4 on map on page 143.

Diagnosis.—Similar in general coloration to *Tana tana tana* of southern Borneo, but even darker and duller in color and with considerably more black on the lower back, forming a fairly well-defined black patch, underparts darker and duller; size very large; hind foot, 53 mm.; condylo-basal length, 59.5.

Skull and teeth.—Aside from their distinctly larger size these do not differ from those of the related subspecies. (Plate 11, fig. 8.)

Measurements.—Type, the only adult specimen known: Head and body, 229 mm.; tail, 196; hind foot, 53; condylo-basal length, 59.5; zygomatic width, 29; width of brain case, 21; maxillary tooth row, 23.

Remarks.—This subspecies is at once distinguished from the others by its large size and dull color. Its distribution would appear to be coincident with that of *Sciurus borneoensis palustris*,[2] and like that squirrel its color appears darker than it does in related subspecies. Doctor Abbott in his field catalogue refers to the large size of this treeshrew. It has hitherto been called by me *Tupaia speciosa*.[3]

Specimens examined.—Two, the type, and a young individual from near Tyan.

TANA TANA UTARA, new subspecies.

Type-locality.—Three thousand feet on Mount Dulit, Baram district, northern Borneo.

Type-specimen.—In British Museum, Reg. No. 99.12.9.5, skin and skull of adult male, collected October, 1898, at 3,000 feet altitude on Mount Dulit, Borneo, by Charles Hose; in good condition.

Geographic distribution.—Northern Borneo, probably confined to the more elevated regions. See No. 3 on map on page 143.

Diagnosis.—A bright-colored subspecies of *Tana tana*, with sides, shoulder, and underparts lighter, and the light areas on either side of the dorsal stripe very light and gray in appearance, black area on back better defined.

[1] Proc. U. S. Nat. Mus., vol. 33, map opposite p. 547, Dec. 24, 1907.
[2] Idem, p. 553, Dec. 24, 1907.
[3] Idem, p. 562, Dec. 24, 1907, and vol. 40, p. 121, Apr. 25, 1911

Skull and teeth.—These appear to be a trifle larger in this subspecies than they do in *T. tana tana*, but the difference is so slight as to be practically negligible.

Measurements.—Type: Hind foot, 50 mm.; condylo-basal length, 55.5; zygomatic width, 28; width of brain case, 20; maxillary tooth row, 21. Usual measurements of adults: Head and body, 225–240; tail, 160–175; hind foot, 47–51; condylo-basal length, 54–57; zygomatic width, 27–28; width of brain case, 20–21; maxillary tooth row, 21–22. For individual measurements see table, page 146.

Remarks.—The brighter colors of this subspecies, and especially the grayish area on either side of the dorsal stripe, are well-marked characters for *T. t. utara*. The most characteristically marked specimens are from Mount Dulit. A single specimen from Mount Mulu, 1,000 feet, British Museum, Reg. No. 94.6.2.1, is larger than the Mount Dulit specimens, is generally "redder," with narrower and grayer areas on either side of dorsal stripe, has a more anterior extension of hazel color of the sides over the shoulder stripe, the dorsal stripe rather reddish and less black on the lower back. If these characters should prove to be constant in Mount Mulu specimens, they would of course represent another race of *Tana tana*. The specimens from British North Borneo are provisionally referred to the present race. The material representing them is poor. Three skins from there in the United States National Museum have been so altered in color by pickling fluid that they are of no systematic value whatever. The reddish elements of the pelage have everywhere been turned to brown, and if one were unaware of their altered condition they would appear to be the most distinct of any of the forms in the genus except *Tana dorsalis*.

Specimens examined.—Fifteen from the Baram district and nine from elsewhere in northern Borneo. See table, page 146.

TANA TANA SIRHASSENENSIS (Miller).

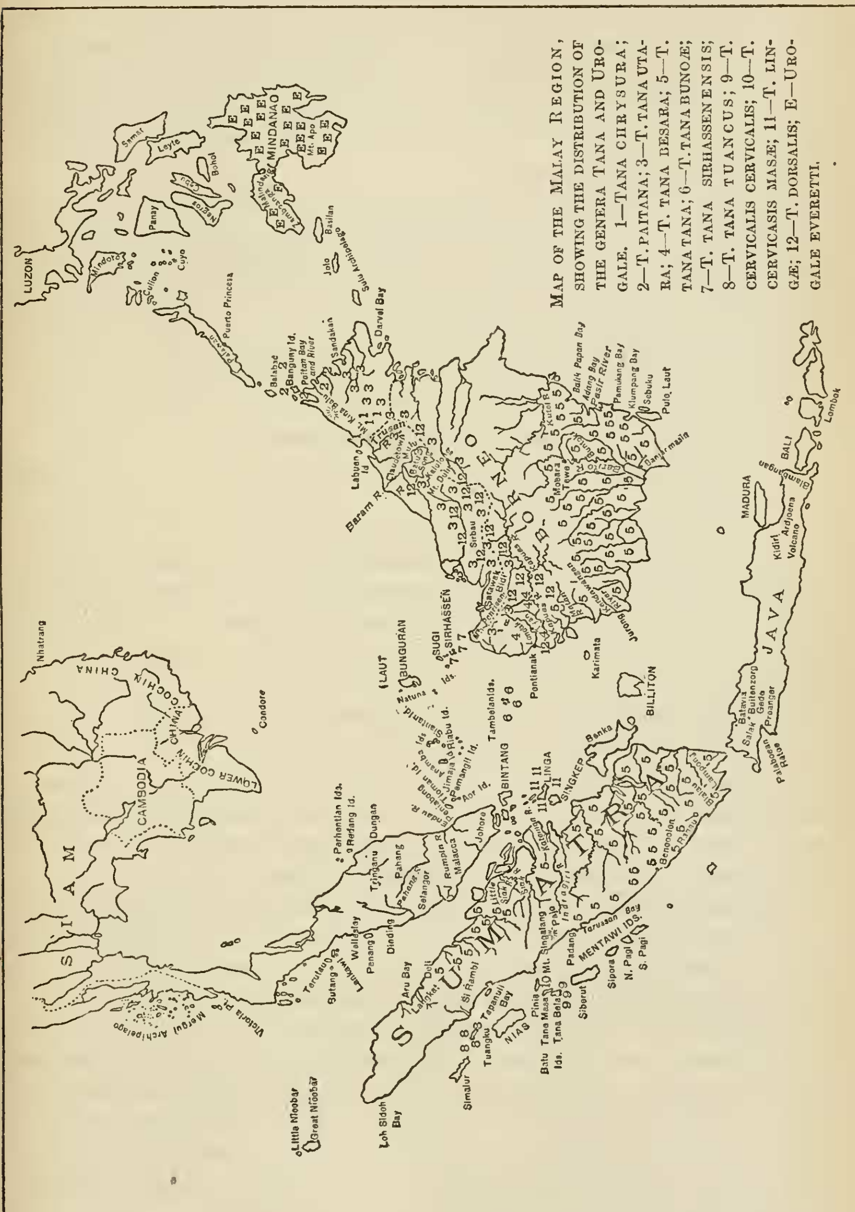
1901. *Tupaia sirhassenensis* MILLER, Proc. Wash. Acad. Sci., vol. 3, p. 133, March 26, 1901.

Type-locality.—Sirhassen, Natuna Islands.

Type-specimen.—In United States National Museum, Cat. No. 104712, skin and skull of adult male, collected on Sirhassen, Natuna Islands, June 5, 1900, by Dr. W. L. Abbott; original number, 442.

Geographic distribution.—Sirhassen Island. See No. 7 on map on page 143.

Diagnosis.—Slightly smaller than either *Tana tana tana* or *T. t. utara* and rather intermediate in color between the two but more like the form from northern Borneo, having the same bright color of the sides, shoulders, and tail, but the upper parts in the region of the dorsal stripe duller and approaching the condition found in *T. t. tana;* in some specimens, including the type, the head, and the light areas on either side of dorsal stripe being quite as dark and



MAP OF THE MALAY REGION, SHOWING THE DISTRIBUTION OF THE GENERA TANA AND UROGALE. 1—TANA CHRYSURA; 2—T. PAITANA; 3—T. TANA UTARA; 4—T. TANA BESARA; 5—T. TANA TANA; 6—T. TANA BUNOÆ; 7—T. TANA SIRHASSENENSIS; 8—T. TANA TUANCUS; 9—T. CERVICALIS CERVICALIS; 10—T. CERVICASIS MASÆ; 11—T. LINGÆ; 12—T. DORSALIS; E—UROGALE EVERETTI.

dull as in the south Bornean race, and in some of the others nearly as bright and light as in the north Bornean race. (Plate 11, fig. 3.)

Measurements.—Type: Head and body, 203 mm.; tail, 152; hind foot, 47; condylo-basal length, 51.5; zygomatic width, 25; width of brain case, 19.5; maxillary tooth row, 20. Maximum and minimum measurements of four adult specimens: Head and body, 203–203 mm.;[1] tail, 152–162;[1] hind foot, 45–47; condylo-basal length, 51.5–53; zygomatic width, 25–26; width of brain case, 19–19.5; maxillary tooth row, 19–20.5. See table, page 149.

Remarks.—Tana tana sirhassenensis is a fairly well-marked form of long-nosed treeshrew, but hardly distinct enough to warrant specific separation. In color it closely resembles the north Bornean race and its maximum measurements easily extend into the range of the mainland forms. In 1894 Thomas and Hartert[2] considered it identical with that form under the name *Tupaia tana.*

Specimens examined.—Eight, all from Sirhassen Island.

TANA TANA BUNOÆ (Miller.)

1900. *Tupaia bunoæ* MILLER, Proc. Wash. Acad. Sci., vol. 2, p. 229, August 20, 1900.

1904. [*Tupaia*] *bunoai* (sic) TROUESSART, Cat. Mam. Suppl., 1904, p. 123.

Type-locality.—Pulo Bunoa, Tambelan Islands, South China Sea.

Type-specimen.—In United States National Museum, Cat. No. 101640, skin and skull of adult female collected on Pulo Bunoa, Tambelan Islands, August 5, 1899, by Dr. W. L. Abbott, in good condition.

Geographic distribution.—The Tambelan Islands, Pulos Bunoa, and Big Tambelan. See No. 6 on map on page 143.

Diagnosis.—Very much like *Tana tana tana* in general coloration, but sides slightly brighter in color, and under parts lighter and paler, tending more toward ochraceous; tail very distinctly shorter, hind foot shorter and skull slightly smaller. (Plate 11, fig. 5.)

Measurements.—Type: Head and body, 210 mm.; tail, 152; hind foot, 45; condylo-basal length, 53.5; zygomatic width, 26; width of brain case, 20; maxillary tooth row, 19.5. The rest of the specimens do not differ materially from the type. See table, page 149.

Remarks.—The shortness of tail and hind foot of this race would be sufficient to warrant its specific distinction from *Tana tana tana* were it not for *T. t. sirhassenensis*, which bridges the gap between them so far as size is concerned. It differs from *T. t. sirhassenensis* in its duller color of the upper parts, and its very much duller and lighter color of the underparts tending to dull ochraceous or ochraceous buff instead of ochraceous rufous.

Specimens examined.—Four, two from Big Tambelan and two from Bunoa, Tambelan Islands.

[1] These measurements were made by Dr. W. L. Abbott in the flesh in inches, the head and body of all the adults being 8 inches; fractions of an inch were probably disregarded.

[2] Nov. Zool., vol. 1, p. 657, September, 1894.

TANA TANA TUANCUS, new subspecies.

Type-locality.—Pulo Tuangku, Banjak Islands, west of Sumatra.

Type-specimen.—In United States National Museum, Cat. No. 114412, skin and skull of adult male, collected on Pulo Tuangku, Banjak Islands, January 29, 1905, by Dr. W. L. Abbott; original number, 1489; in good condition.

Geographic distribution.—Known only from Pulo Tuangku, but probably occurring on other islands of the Banjak group. See No. 8 on map on page 143.

Diagnosis.—Most like *Tana tana sirhassenensis*, but body colors rather brighter and redder, underparts darker and redder, especially underside of tail; light elements on either side of dorsal stripe, more ochraceous-buff; in *T. t. sirhassenensis*, buff; in *T. t. tana*, cream buff.

Measurements.—Type: Head and body, 215 mm.; tail, 160; hind foot, 46; condylo-basal length, 53; zygomatic width, 26.5; width of braincase, 20.5; maxillary tooth row, 20.5. See table, page 149.

Remarks.—This is a rather well-marked subspecies, easily distinguished by its rich dark colorings, and the ochraceous elements on either side of the dorsal stripe. The specimens on which this form is based were regarded as true *T. tana tana* in 1903.[1]

Specimens examined.—Two, both from Pulo Tuangku.

TANA LINGÆ, new species.

Type-locality.—Linga Island, between Sumatra and Malay Peninsula.

Type-specimen.—In United States National Museum, Cat. No 101597, skin and skull of adult male, collected at 2,000 feet altitude on the peak of Linga Island, July 16, 1899, by Dr. W. L. Abbott; in good condition.

Geographic distribution.—Known only from Linga Island. See No. 11 on map on page 143.

Diagnosis.—Almost identical in color with *Tana tana sirhassenensis*, the only noticeable difference being the greater narrowness and less conspicuousness of the dorsal stripe, but as the only specimen has a small albinistic spot at about the middle of the dorsal stripe, that difference may be more apparent than real. The species is at once distinguished from other members of the genus by its small-size, hind foot 40 mm., condylo-basal length of skull 50.5. In addition to its small size the skull is further distinguished by its slender attenuate rostrum, having a rather abrupt origin from the rest of skull, and by its smaller more rounded bullæ. (Plate 11, fig. 2.)

Measurements.—Type and only known specimen: Head and body, 191 mm.; tail, 133; hind foot, 40; condylo-basal length, 50.5; zygomatic width, 25; width of brain case, 19.5; maxillary tooth row, 19.5.

Remarks.—Owing to the absence of specimens of the genus *Tana* from Sumatra until within the last year, this specimen from Linga

[1] See Miller, Proc. U. S. Nat. Mus., vol. 26, p. 472, February 3, 1903.

has previously been identified [1] with *Tana tana*. While it is clearly related to that species, yet its small size and narrow rostrum serve to distinguish it very clearly. Additional material, however, may show that it grades in with the smaller subspecies of *Tana tana*.

Specimen examined.—One, the type.

Measurements of Tana tana utara and T. t. besara.

Name.	Locality.	Number.	Sex.	Molar teeth worn.	Head and body.	Tail.	Hind foot.	Condylo-basal length.	Zygomatic width.	Width of brain case.	Maxillary tooth row.	Number of mammæ.
					mm	*mm*	*mm*	*mm*	*mm*	*mm*	*mm*	
T tana utara	British North Borneo.	1/3/2/3/4/3/6/5/4	Female.	Moderately.	.....	.....	42	....	26±	22	20.5	2-2
Do	do	19225	do	.....	.....	.....	42±	(2)	.....	.....	.....	2-2
Do	British North Borneo, Kinabatangan River.	1/3/1/3/7/4/3/6	Male	Moderately.	.....	.....	45	57	28	21.5	21	....
Do	British North Borneo.	34943	.....	Slightly	.....	.....	(3)	56	26.5	20.5	22	....
Do	do	34944	.....	Unworn	.....	.....	(3)	53	25	21	20.5	....
Do	British North Borneo, Suanalamba River.	1/3/2/3/3/6/9/5	.....	Moderately.	.....	.....	(3)	....	.....	.....	21	....
Do	Sandakan, Northwest Borneo.	78.4.26.2	.....	None	.....	.....	51	....	26.5	20.5	22.5	....
Do	Borneo, Sarawak.	83938	Female.	Slightly	.....	.....	47	58	23.5	....	21	2-2
Do	Mount Dulit, 1,000 feet, North Borneo.	99.12.9.4	Male	Much	.....	.....	48	56	28	21	20.5	....
Do	Mount Dulit, 3,000 feet, North Borneo.	99.12.9.5 [4]	do	Moderately.	.....	.....	50	55.5	28	20	21	....
Do	Mount Dulit, 4,000 feet, North Borneo.	92.2.7.4	do	do	.....	.....	47	54	27	21	20.5	....
Do	Mount Mulu, 1,000 feet, North Borneo.	94.6.2.1	do	Slightly	.....	.....	50	60	29	21	22	....
Do	Mount Penrisen, Borneo.	90.6.25.2	.....	do	.....	.....	51	....	28	21	22	....
Do	Base of Mount Song, Borneo.	92.9.6.30	.....	None [5]	.....	.....	46	....	....	19.5	19	....
Do	Bukit Sebau, Sarawak, Borneo.	5.3.1.4	Male	None [8]	.....	.....	50	47.5	....	20	....	....
Do	Borneo, Mount Dulit.	6/9/2/4, Geneva.	Female.	None [7]	225±	170±	50±	56.5	26	22	21	2-2
Do	Borneo, Sarawak.	Berlin, 4453.[8]	Male	.....	225	175	53	....	....	....	....	....
Do	do	Berlin, 7283.	.....	(9)	230±	160±	49	....	....	....	....	....
Do	do	Genoa [8]	Female.	Adult	230	175	49	....	....	....	....	2-2
Do	do	do [8]	Male	None [6]	155	140	47	43.5	23	20.5	....	....
Do	do	do [8]	Female.	Adult	240	160	51	....	....	....	....	2-2
Do	do	Genoa 5a	Male	.....	205±	155±	52±	....	....	....	....	....
Do	do	do 5c	do	.....	230±	165±	50±	....	....	....	....	....
Do	do	Genoa 6a	.....	None [6]	170±	155±	45±	44	....	20	....	....
T. tana besara.	Borneo, Kapuas River, Tyan District.	142246	Male	do	190	155	50	47	23.5	20	....	....
Do	Borneo, Kapuas River, opposite Pulo Jambu.	142247 [4]	do	Slightly	229	196	53	59.5	29	21	23	....

[1] Miller, Proc. Wash. Acad. Sci., vol. 2, p. 229, August 20, 1900.
Miller, Proc. U. S. Nat. Mus., vol. 31, p. 271, September 11, 1906.
Lyon, Proc. U. S. Nat. Mus., vol. 36, p. 490, June 1, 1909.
[2] Skin only, no skull.
[3] Skull only, no skin.
[4] Type.
[5] m^3 just appearing.
[6] m^1 last tooth in place.
[7] pm^4 half way through alveolus.
[8] Preserved in alcohol.
[9] Skull in skin.

TANA CERVICALIS (Miller).

(Synonymy, type-specimens, etc., under the subspecies.)

Geographic distribution.—The Batu Islands off the west coast of Sumatra. See Nos. 9 and 10 on map on page 143.

Diagnosis.—The two members of this species differing considerably from each other are distinguished from *Tana tana* by their bright ruddy style of coloration accompanied with a large and well defined brilliant black area on the lower back; mammæ, 2–2=4.

Color.—Sides of body, tail, outer side of legs dark, rich ferruginous, washed or lined with black about base of tail, middle of sides and thighs, the black becoming conspicuous on the lower back where it may form a well defined black patch of moderate area or spread over almost the entire posterior portion of body in a brilliant black pattern, underparts of body including inner side of legs bright cinnamon rufous; underside of tail rich ferruginous, darkening to burnt sienna along the edges; light area on either side of the dorsal stripe varying from a grizzled mixture of blackish and cream-buff to a mixture of blackish and tawny ochraceous; shoulder stripe cream buff to ochraceous.

Skull and teeth.—There are no characters by which the skull and teeth of *Tana cervicalis* may be distinguished from those of related species, nor the different forms from each other.

Measurements.—Head and body, 205–215 mm.; tail, 155–165; hind foot, 43–47; condylo-basal length, 53–54; zygomatic width, 25–26; width of brain case, 19.5–20; maxillary tooth row, 20–21.5.

Subspecies.—Two subspecies of *Tana cervicalis* may be recognized: *T. cervicalis cervicalis*, Tana Bala; *T. cervicalis masæ*, Tana Masa, Batu Islands.

Remarks.—*Tana cervicalis* is not distantly removed from *T. tana*, but is immediately distinguishable by the large, conspicuous brilliant black area of the lower back. This character, however, is only one of degree, for in *T. tana* many examples are seen where a darkened or even black area exists on the lower back, but it is never so intense in color, or so large, extending so far on the sides, or so far anteriorly.

TANA CERVICALIS CERVICALIS (Miller).

1903. *Tupaia cervicalis* MILLER, Smiths. Misc. Coll., vol. 45, p. 59, November 6, 1903.

Type-locality.—Tana Bala, Batu Islands, off west coast of Sumatra.

Type-specimen.—In United States National Museum, Cat. No. 121754, skin and skull of adult male collected on Tana Bala, Batu Islands, February 14, 1903, by Dr. W. L. Abbott; original number, 2294; in good condition.

Geographic distribution.—Tana Bala Island. See No. 9 on map on page 143.

Diagnosis.—Distinguished by the great extent and intensity of the black area of the lower back, extending forward to meet in striking contrast the light area beside the dorsal stripe, and also well down on the sides of body and on base of tail; light areas beside the dorsal stripe very light and conspicuous, a mixture of buff and black, the former in excess; shoulder stripe cream buff. (Plate 11, fig. 7).

Measurements.—Type: Head and body, 210 mm.; tail, 165; hind foot, 47; condylo-basal length, 54.5; zygomatic width, 25; width of braincase, 20; maxillary tooth row, 21.5. For measurements of a second specimen see table, page 149.

Remarks.—*Tana cervicalis cervicalis* is a very well marked form, and conspicuous animal. The rich ferruginous tones of the sides and tail, the brilliant black of the lower back, and the light areas of the neck and bordering the dorsal stripe, make *T. cervicalis cervicalis* the handsomest animal in the family Tupaiidæ.

Specimens examined.—Two, both from Tana Bala.

TANA CERVICALIS MASÆ, new subspecies,

Type-locality.—Tana Masa, Batu Islands, west of Sumatra.

Type-specimen.—In United States National Museum, Cat. No. 121835, skin and skull of adult female, collected on Tana Masa, Batu Islands, February 18, 1903, by Dr. W. L. Abbott; original number, 2302; in good condition.

Geographic distribution.—Tana Masa Island. See No. 10 on map on page 143.

Diagnosis.—A member of the species *Tana cervicalis*, characterized by having the light areas on either side of the dorsal stripe tawny ochraceous slightly mixed with blackish, the black area of the back not quite so well developed, nor extending so far forward, and the reddish colors of maximum intensity, head relatively dark.

Remarks.—This race appears to be a well-defined one and quite different in appearance from *Tana cervicalis cervicalis* on the nearby island of Tana Bala so far as the anterior portions of the body are concerned, but the posterior halves of the two animals are essentially alike except that *T. c. masæ* has the darker coloration of the two. Anteriorly *T. c. masæ* more closely resembles the form from the Banjak Islands. This form was identified by me in 1908 as identical with the Tana Bala form.[1]

Specimens examined.—Two, both from Tana Masa.

[1] Ann. Mag. Nat. Hist., ser. 8, vol. 1, p. 138, February, 1908.

Measurements of insular forms of the genus Tana.

Name.	Locality.	Number.	Sex.	Molar teeth worn.	Head and body.	Tail.	Hind foot.	Condylo-basal length.	Zygomatic width.	Width of brain case.	Maxillary tooth row.	Number of mammæ.
					mm	*mm*	*mm*	*mm*	*mm*	*mm*	*mm*	
T. cervicalis cervicalis.	Batu Islands, Tana Bala.	121753....	Female.	.....	215	150	46	....	....	....	....	2-2
Do.....	.....do.....	121754 [1]...	Male....	Slightly....	210	165	47	54.5	25	20	21.5	....
T. cervicalis masæ.	Batu Islands, Tana Masa.	121835 [1]...	Female.	Much.....	216	154	46	54	26	19.5	20	2-2
Do.....	.....do.....	7.6.18.6...	...do...	Moderately	.....	.....	47	54	26	20	21	2-2
T. lingæ.....	Linga Island.....	101597 [1]...	Male....	.....do.....	191	133	40	50.5	25	19.5	19.5	....
T. tana bunoæ.	Tambelan Islands, Bunoa.	101640 [1]...	Female.	Slightly....	210	152	45	53.5	26	20	19.5	2-2
Do.....	.....do.....	101641....	Male....	Moderately	203	152	43	53	26.5	20	20	....
Do.....	Tambelan Islands, Big Tambelan.	101653....	Female.	Slightly....	184	.....	44	....	25±	19.5	19.5	....
Do.....	.....do.....	101654....	Male....	Moderately	178	152	43	51	25	19.5	19	....
T. tana tuancus.	Banjak Islands, Tuanku.	114412 [1]...	...do...	Slightly....	215	160	46	53	26.5	20.5	20.5	....
Do.....	.....do.....	114413....	Female.	Much.....	205	160	43	53.5	26	21	20.5	2-2
T. tana sirhassenis.	Natuna Islands, Sirhassen.	104709....	Male....	None [2].....	178	146	45	47	23	20	19.5	....
Do.....	.....do.....	104710....	...do...	Slightly....	203	162	47	51.5	25	19.5	20	....
Do.....	.....do.....	104711....	Female.	.....do.....	203	158	46	53	26	19	20.5	2-2
Do.....	.....do.....	104712 [1]...	Male....	.....do.....	203	152	47	51.5	25	19.5	20	....
Do.....	.....do.....	104713....	Female.	Moderately	203	162	45	52.5	25.5	19	20	2-2
Do.....	.....do.....	94.9.28.5..	.....	None [3].....	.....	.....	45	....	....	19	19	....
Do.....	.....do.....	94.9.28.4..	Female.	Moderately	.....	.....	45	....	25	19	20	2-2
Do.....	.....do.....	Paris 15 B..	.....	.....	220±	140±	46	....	....	....	....	....

[1] Type. [2] *m* [2] just through alveolus. [3] *m* [3] just appearing.

TANA CHRYSURA (Günther).

1876. *Tupaia tana* var. *chrysura* GÜNTHER, Proc. Zool. Soc. London, 1876, p. 427; pl. 36, entire animal in colors, fairly good.

Type-locality.—Mainland of Borneo, opposite the island of Labuan.

Type-specimen.—In British Museum, Reg. No. 76.5.2.19, collected by Mr. Hugh Low on Borneo, opposite the island of Labuan; in good condition except that occipital region of skull has been cut away.

Geographic distribution.—Known only from the region of the type-locality. See No. 1 on map on page 143.

Diagnosis.—Color pattern generally similar to that of *Tana tana*, but tail instead of being concolor with body is uniformly buffy, and very different in color from rest of animal. Mammæ unknown.

Color.—Much like the color of *Tana tana*, but the gray of the head, neck, shoulders, and area bordering the dorsal stripe more pronounced and clear; general body color, including outer side of legs, less reddish than in *T. tana*, of a color between mars and mummy brown, inclining to blackish on the lower back; underparts, including inner side of legs, dull orange rufous; entire tail, above and below, buff, tinged with clay color in places; shoulder stripe, whitish.

Skull and teeth.—They do not differ materially from those of *Tana tana;* the rostrum is, perhaps, a little wider in *T. chrysura* than in species commonly seen on Borneo.

Measurements.—Type: Head and body (from dried skin), 240± mm; tail (from dried skin), 160±; hind foot, 52; zygomatic width, 29; width of brain case, 21.5; maxillary tooth row, 22. For individual measurements see table, page 151.

Remarks.—*Tana chrysura* is a well-marked form. Its buff-colored tail serves at once to distinguish it from other members of the genus. In addition to the difference in color of the tail, it also differs in its general color from *T. tana.* This to my mind shows it to be no mere color phase of *T. tana,* but a perfectly distinct species. This view is further advanced by the fact that *Tana chrysura* has not yet been secured in Borneo other than in the vicinity of the type-locality, and that no specimens of *T. tana* have been taken at the type-locality of *T. chrysura.* Its analogy with *Tupaia demissa,* page 58, is interesting.

Specimen examined.—Seven, all from the vicinity of the type-locality.

TANA PAITANA, new species.

Type-locality.—Paitan River, northeastern Borneo.

Type-specimen.—In British Museum, Reg. No. 93.4.1.1, skin and skull of adult, collected along the Paitan River, northeastern Borneo, July, 1892, by A. Everett; in good condition, but skull somewhat damaged posteriorly.

Geographic distribution.—Known only with certainty from the type-locality, but represented on Banguey Island by the same or a closely allied form. See No. 2 on map on page 143.

Diagnosis.—Differs conspicuously from *Tana tana* in the greater development of yellowish gray light areas on either side of the dorsal line so as to embrace the area of the shoulder stripe, instead of having it embraced by the reddish brown color of the sides. Mammæ unknown.

Color.—Much brighter and "redder" than is *Tana tana* on the sides, legs, and lower back; the lower back without any evident black patch and nearly as clear ferruginous as are the sides; the light areas on anterior half of back more extensive and lighter than in any other form, with the general effect of a yellowish gray instead of the rather clear gray seen in *Tana tana utara,* the light shoulder stripe being entirely surrounded by this yellow gray area, and not bordered above and below by a forward extension of the ferruginous color of the sides, underparts not essentially different from those of *Tana tana.*

Skull and teeth.—These show no special distinguishing features and are apparently indistinguishable from those of *Tana tana.*

Measurements.—Type: Head and body (dried skin), 260 mm.; tail (dried skin), 160; hindfoot, 50; zygomatic width, 28; width of brain case, 21; maxillary tooth row 22.

Remarks.—*Tana paitana* appears to be a very distinct species, nearly as much so as *T. chrysura*, the surrounding of the shoulder stripe by the grayish of the anterior back being a feature unknown in other species; the distinct ferruginous instead of blackish color of the lower back is also distinctive. It appears to be more nearly related to *Tana chrysura* than to *T. tana* as far as its general coloration is concerned, excepting of course the tail. *T. chrysura* has rather large grayish areas on the anterior back, but they do not embrace the shoulder stripe. The specimen from Banguey Island is provisionally referred to *T. paitana*. The specimen is immature, and it does not appear advisable to found a new name on its smaller size and more blackish lower back.

Specimens examined.—Two, the type, and one from Banguey Island, off northeastern Borneo.

Measurements of Tana chrysura and paitana.

Name.	Locality.	Number.	Sex.	Molar teeth worn.	Head and body.	Tail.	Hind foot.	Condylo-basal length.	Zygomatic width.	Width of brain case.	Maxillary tooth row.	Number of mammæ.
					mm	*mm*	*mm*	*mm*	*mm*	*mm*	*mm*	
T chrysura	Borneo, Lumbidan [1].	63023 [2]	.....	Moderately.	.....	.....	50±	54	26	20.5	20.5	....
Do.....	Borneo, opposite Labuan.	76.5.2.19 [3]	Male.	.....do.....	240±	160±	52	....	29	21.5	22	....
Do.....	Borneo, Lumbidan [1].	93.4.1.2	.....	Much	255±	155±	49	56	29	20	21	....
Do.....	.....do.....	94.7.2.6	.....	None [4].....	220±	160±	48	....	....	18.5	....	....
Do.....	Borneo, opposite Labuan.	76.5.2.20	.....	.....do. [5]...	.....	.....	47	....	23.5	20.5	21	....
Do.....	Borneo, Lumbidan [1].	94.7.2.54 [6]	Male.	.....	230	185	52	....	....	....	....	....
Do.....	.....do.....	Paris, 2229.	.....	Slightly	250±	160±	51±	....	....	20.5	21.5	....
T. paitana.	Borneo, Paitan River	93.4.1.1 [3]	.....	Moderately.	260±	160±	50	....	28	21	22	....
Do.....	Banguey Island, Borneo.	94.7.2.8	Male.	None [7].....	230±	140±	45	....	....	20	21	....

[1] Lumbidan directly opposite Labuan. See Everett, Journ. Straits Branch Royal Aslat. Soc., vol. 20, 1889, p. 93.
[2] Has two small supernumerary *pm*s on left side.
[3] Type.
[4] m^1 last tooth in place.
[5] m^2 last in place.
[6] Preserved in alcohol.
[7] Deciduous incisors still in place.

TANA DORSALIS (Schlegel).

1857. *Tupaja dorsalis* SCHLEGEL, Handl. Beoef. Dierk., p. 59, pl. 3, fig. 31, two-fifths nat. size, in black and white, 1857.

1890. *Typaia dorsalis*, JENTINK, Notes Leyden Museum, vol. 12, p. 228, 1890.

Type-locality.—Lower Kapuas River, western Borneo.[1]

Type-specimens.—Cotypes in Leyden Museum,[2] mounted skins "*b*" and "*g*," under *Tupaja tana* of Jentink's Catalogues, of which they are there considered young examples, and skull "*f*" under *T. tana*. Skin "*g*" was collected by M. Schwaner in Borneo, along the Kapuas River. I have not seen these cotypes.

Geographic distribution.—Known from western and northern Borneo, but probably occurring elsewhere in the island. See No. 12 on map on page 143.

Diagnosis.—A very well-marked species of the genus *Tana* characterized by its small size, short claws, narrow dorsal stripe extending from nape almost to base of tail. Mammæ 2–2=4.

Color.—Upper parts and sides of anterior parts of body, with the general effect of olive, produced by a fine grizzling of blackish and buffy, upper parts and sides of posterior parts of body, with the general effect of burnt umber, produced by a fine grizzling of blackish and tawny. The line of demarcation between the two colors is not sharp, but they gradually blend one with the other; the olive color in most specimens occupies more than the anterior half of body, but in some the olive and burnt umber are about equally divided. Extending through the middle of both colors from the nape almost to the root of tail is the narrow (2–3 mm.) black dorsal line, slightly wider at the middle than at the ends. Top and sides of head, intermediate in color between the olive of the anterior parts of body and the burnt umber wash of the posterior parts. Outer side of hind legs similar to adjacent parts of body; outer side of fore legs intermediate in color between the head and the anterior parts of body. Tail above the same color as the lower back, at base, becoming dark brownish toward the end; underside of tail similar to the color above for the outer half of hairs, russet for the inner half of hairs; underparts, including innerside of legs, dull buffy to ochraceous buff, clearest in the region of the throat, elsewhere obscured by the slaty bases of the hairs showing through; shoulder stripe fairly conspicuous, cream buff or buff. (Plate 6, fig. 2.)

Skull and teeth.—The skull of *Tana dorsalis* is mainly distinguished by its smaller size, but the rostrum is relatively less slender and attenuate. The difference in size between *Tana dorsalis* and the smallest member of the *tana* group, *T. lingæ*, is not greater than

[1] See Jentink, Notes Leyden Museum, vol. 12, 1890, p. 228, and also Cat. Syst. Mamm. Mus. Hist. Nat. Pays-Bas, vol. 12, 1888, p. 116.

[2] See Jentink, Notes Leyden Museum, vol. 12, 1890, p. 228, and also Cat. Ost. Mamm. Mus. Hist. Nat. Pays-Bas, vol. 9, 1887, p. 240.

between the largest, *T. tana besara*, and the smallest members of the *tana* group. The first and second upper molars of *T. dorsalis* are more quadrate in outline than they are in the *tana* group and have relatively better developed hypocones; the last upper molar is relatively larger and with a better developed metacone, and the hypocone of pm^3 is better developed. resembling that of pm^2 on a small scale. (Plate 11, fig. 1.)

Measurements.—Usual measurements of adults: Head and body, 175–200 mm.; tail, 140–150; hindfoot, 42–45; condylo-basal length, 45–46.5; zygomatic width, 22–24; width of brain case, 18–19; maxillary toothrow, 17–18. See table below.

Remarks.—*Tana dorsalis* is one of the best marked forms in the subfamily Tupaiinæ, and needs no comparison with any other species. It is so different from the members of the *tana* group in the genus *Tana* that it might almost be made the type of a distinct subgenus, mainly on the basis of the small size of the claws, as well as upon the tooth differences, but the latter are relatively slight. Nothing appears to be published regarding its habits, but judged by the structure of its feet, it probably leads a rather different life than does the *tana* group.

Its association with the long-snouted treeshrews was pointed out by Jentink in 1890.[1]

Specimens examined.—Fifteen, from various localities in western and northern Borneo.

Measurements of Tana dorsalis.

Locality.	Number.	Sex.	Molar teeth worn.	Head and body.	Tail.	Hind foot.	Condylo-basal length.	Zygomatic width.	Width of brain case.	Maxillary tooth row.	Number of mammæ.
BORNEO.				*mm*	*mm*	*mm*	*mm*	*mm*	*mm*	*mm*	
Sarawak, Baram	83939	Female	None	----	----	45±	----	22±	18	18	2–2
Sarawak, Mount Dulit	84505	Male	....do.[2]	----	----	43	45	22.5	19	18.5	----
Kapuas River, Pulo Saparo	142245	Female	Slightly	175	145	42	45±	22	18.5	17	2–2
Trusan, opposite Labuan	87.7.14.1	Male	....do	----	----	45	----	23.5	18.5	17.5	----
Mount Penrisen, Sarawak	90.6.25.3	Female	(3)	185±	140±	44	----	----	----	----	2–2
Do	90.6.25.4	----	(3)	180±	145±	43	----	----	----	----	----
Balingean	5.3.1.6	Male	None[4]	190±	145±	45	45.5	----	19.5	----	----
Mount Dulit, 1,000 feet	99.12.9.10	Female	....do.[5]	----	----	40	45±	20.5	18	17.5	2–2
Baram, Apoh	92.2.8.2	...do	Moderately	----	----	40	----	----	----	18	2–2
Mount Batu Song, 4,000 feet	92.11.8.2	...do	Much	----	----	41	----	----	----	17	----
Mount Mulu, 1,000 feet	94.5.2.4	Male	Slightly	----	----	44	46.5	23	18.5	18	----
Mount Dulit, 3,000 feet	Genoa	...do	(3)	220±	150±	44	----	----	----	----	----
Baram River, Sarawak	Berlin	Female	(3)	210±	150±	40	----	----	----	----	2–2
Baram, Sarawak	Paris, 901	----	----	200±	155±	44	46	24	19	----	----
Mount Kalulong, Sarawak	Paris, 286	----	----	195±	150±	43	----	----	----	----	----

[1] Notes Leyden Museum, vol. 12, 1890, p. 228.
[2] dpm^4 still in place.
[3] Skulls in the skins.
[4] di^1 and di^2 still in place.
[5] m^3 halfway through.

Genus UROGALE Mearns.

1905. *Urogale* MEARNS, Proc. U. S. Nat. Mus., vol. 28, p. 435, May 13, 1905.

Type.—*Urogale cylindrura* Mearns = *U. everetti* (Thomas).

Diagnostic characters.—A large member of the family Tupaiidæ, easily distinguished externally by its elongated snout and close-haired rounded tail, and cranially by its long rostrum, small zygomatic fenestra, and dentally by the large size and canine-like appearance of i^2 and the small rudimentary condition of i_3.

External characters.—*Urogale*, externally, is like the genus *Tana*, with the exception that the tail is not bushy or distichous, but rather close haired. The tail has the same relative length to the head and body that it has in *Tana*, but because of the shorter hairs appears much smaller. The naked area on the nose, the ear, the shoulder stripe, and the arrangement of footpads show no differences in the genera *Tana* and *Urogale*. The claws, especially those of the fore feet, are particularly long and sharp like those of *Tana tana*. The color pattern does not show a dorsal stripe. The mammæ are 2–2 = 4. (Plate 6, fig. 3.)

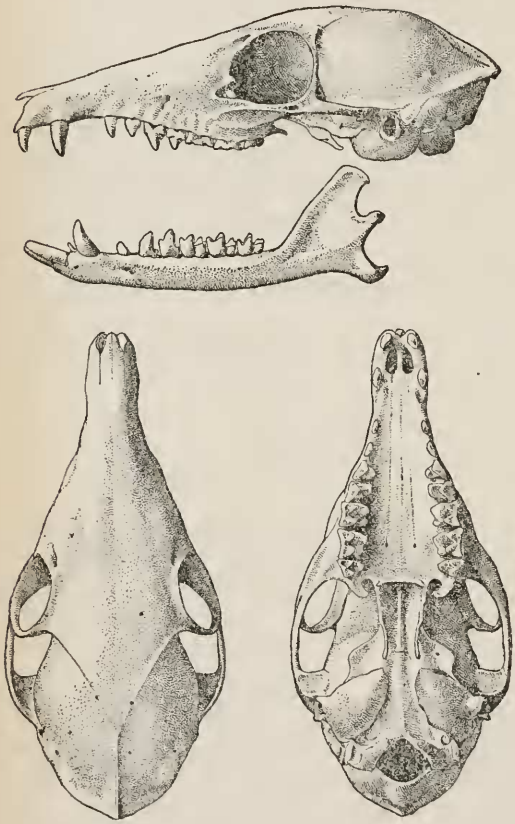


FIG. 12.—UROGALE EVERETTI; TYPE × 1; REG. NO. 79.5.3.11, BRITISH MUSEUM, ZAMBOANGA, MINDANAO, PHILIPPINE ISLANDS.

Cranial characters.—The skull of *Urogale* is built on the same general plan as that of *Tana*, but differs in many important features. The skull of *Urogale* on the whole is heavier and more angular, although it is scarcely larger than that of *Tana;* the rostrum is relatively heavier, has a more abrupt origin from the skull, and is enlarged just back of the extremity to accommodate the canine-like incisors; the temporal ridges are more prominent, but shorter, so that they

meet at a more anterior point, forming a sagittal crest or ridge quite as long as each temporal ridge. In *Tana* the sagittal ridge is much lower and only about a third or a fourth the length of the less conspicuous temporal ridges. The surface for the attachment of the temporal muscles is thus much greater in *Urogale* than in *Tana* or *Tupaia*. The coronoid process of the mandible is correspondingly increased in size. In *Urogale* the lambdoid region of the skull projects further posteriorly than in *Tana* or *Tupaia*, and when viewed from behind, the two ridges make a more acute angle than they do in the the other genera. The fenestra in the zygoma of *Urogale* is reduced to an almost invisible slit. A rather conspicuous grooved surface is found on the underside of the maxillary zygomatic root. In *Tana* this surface is much smaller and less conspicuous. The zygomata are more spreading in *Urogale* than in *Tana* or *Tupaia*. The bony palate is more ossified in *Urogale* and without the vacuities more often seen than not in *Tana* and *Tupaia;* the interpterygoid space is slightly narrower; the external plate larger and plate-like instead of forming a short wide hook, as in *Tana*. The greatest width of the brain case is about the same in *Urogale* and the large species group of *Tana*, but it rapidly narrows anteriorly, so that the postorbital constriction is distinctly less than the preorbital; in *Tana* the reverse condition holds. The orbit is relatively and absolutely slightly smaller in *Urogale* than in *Tana*. When the skulls of the two genera are looked at from above, the posterior bar of the orbit divides the space between the zygoma and the rest of the skull into two approximately equal parts, one anterior and one posterior, in *Urogale;* in *Tana* the anterior portion is distinctly the larger of the two. The mandible of *Urogale* is distinctly heavier and more massive than that of *Tana* or *Tupaia* and the ascending ramus larger and more upright, especially seen in the coronoid and angular processes; the condyle is also somewhat larger. See figure 12, page 154. (Plate 11, fig. 6.)

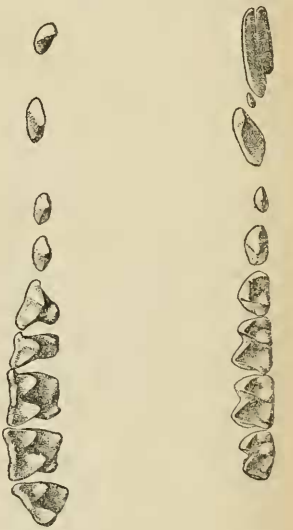


FIG. 13.—UPPER AND LOWER TOOTH-ROWS OF UROGALE EVERETTI; TYPE, × 2; REG. NO. 79.5.3.11, BRITISH MUSEUM, ZAMBOANGA, MINDANAO, PHILIPPINE ISLANDS.

Dental characters.—*Urogale* differs more in respect to its teeth from the other members of the subfamily Tupaiinæ than in respect to its skull. The second pair of upper incisors are enormously developed and are rather canine-like in form, but straighter than the ordinary canine tooth, so that instead of having a backward curving fang the axis

of this large tooth is so placed that the straight fang is directed downward and backward. The canine tooth itself is slightly better developed than it is in *Tana* or *Tupaia*, but owing to the great size of the incisor just in front it is scarcely noticed. In the mandible the first two incisors are essentially as they are in *Tana* or *Tupaia*, but the third lower incisor is very small, functionless, and sometimes deciduous. The lower canine is well developed, to match with the canine-like second upper incisor. While the lower canine and the second upper incisor undoubtedly perform the functions of upper and lower canines, yet it is interesting to notice that the positions of the two teeth are reversed, the lower canine being placed posterior to the tooth that functions as the upper canine, whereas in the case of true canines the lower tooth cuts in front of the upper tooth.

The upper and lower series of premolars in *Urogale* are essentially as they are in *Tupaia* or *Tana*, but both of the last premolars are relatively better developed in *Urogale* and apparently of better service to the animal. This is particularly well shown in the protocone of pm^4, which is quite large and has nearly the same relative degree of development as is found in that tooth in *Anathana*. The lower molar series of *Urogale* and *Tupaia* are indistinguishable. The upper series are nearly alike in the two genera, but the hypocones of m^1 and m^2 are much better developed in *Urogale* than they are in *Tupaia* or *Tana*, being nearly as large as in *Anathana*. (See figure 13, page 155.)

Geographic distribution.—So far as known *Urogale* occurs on only one island, Mindanao, of the Philippines. See E on map on page 143.

Number of forms.—*Urogale* contains but a single species, *U. everetti*.

Remarks.—*Urogale*, while clearly belonging to the subfamily with *Tupaia*, *Tana*, *Anathana*, and *Dendrogale*, is more different from them than any of them differs among themselves. With which one it has the closest affinity it is hardly possible to say. In most respects it has many points of real resemblance to the genus *Tana* and in some ways may be looked upon as the *Tana* type carried to an extreme. My own view is that both have been derived from some common ancestor different from *Tupaia*, and that owing to its isolation and smallness of the land area on which it is found, *Urogale* went farther than did *Tana*. The habits and food of *Urogale* probably differ considerably from those of the rest of the subfamily. From the development of its teeth, elongated rostrum, generally heavy build, one would suppose it to be a more predatory and carnivorous animal than any other member of the subfamily.

The two specimens collected by Dr. E. A. Mearns on Mount Apo were snared in trees by natives, and the one from Mount Malindang was shot on a tree stump. It had been observed several days before, and in its actions resembled a chipmunk.

UROGALE EVERETTI (Thomas).

1892. *Tupaia everetti* THOMAS, Ann. Mag. Nat. Hist., ser. 6, vol. 9, p. 250, March, 1892.

1905. *Urogale cylindrura* MEARNS, Proc. U. S. Nat. Mus., vol. 28, p. 435, May 13, 1905. (Type-specimen, in United States National Museum, Cat. No. 125287, collected by Doctor E. A. Mearns at 4,000 feet on Mount Apo, Mindanao, July 12, 1904; original number, 5727; skin and skull in good condition.)

Type-locality.—Zamboanga, Mindanao, Philippine Islands.

Type-specimen.—In British Museum, Reg. No. 79.5.3.11, adult male, collected at Zamboanga, Mindanao, Philippine Islands. The original entry in the Register says "in spirit," but the specimen has for some time been made into a modern study skin in good condition. Aside from some cracks about braincase, the skull is in good condition. With the principal exception of the pelvis, most of the skeleton exists.

Geographic distribution.—Mindanao, Philippine Islands. Specimens from Mount Apo, Zamboanga, and Mount Malindang. See E, on map on page 143.

Diagnosis.—As for the genus above.

Color.—General effect of upper parts of head, neck, body, and tail and outer side of legs a color between mummy and seal brown, produced by a fine grizzling of blackish and tawny, the blackish brown in excess, about nose and sides of head, the tawny color replaced by raw sienna and more of it; feet similar to legs but darker, and with almost none of the lighter color; underparts, including inner side of legs, varying from ochraceous to ochraceous rufous brightest in region of the chest, the slaty bases of the hairs showing through in places to a considerable extent; underside of tail similar to upperside, but the light and dark color elements about equally mixed; shoulder stripe rather poorly defined, ochraceous. The type-specimen is dull and rusty in comparison with the modern skins, the difference probably being due to its original preservation in alcohol; its underparts are dull brown and tail quite rusty.

Skull and teeth.—Skull large and angular, with relatively heavy rostrum rising abruptly from rest of skull, enlarged just back of extremity to accommodate roots of the large second pair of incisors; temporal ridges short but prominent, sagittal crest rather long and high; fenestra in zygoma reduced to a minute slit; bony palate well ossified, usually without vacuities; postorbital constriction less than preorbital constriction. Second pair of upper incisors enormously developed, functioning as canines, third lower incisors, small, functionless and sometimes deciduous; last upper and lower premolars well developed, especially protocones on upper tooth; lower canine conspicuously developed. (See fig. 12, p. 154; fig. 13, p. 155; also plate 11, fig. 6.)

Measurements.—Type of *U. everetti* and of *U. cylindrura:* Head and body, 235 mm. (dried skin), 182; tail, 170 (dried skin), 163; hind-

foot, 51, 50; condylobasal length, 58, 58.5; zygomatic width, 29, 29; width of braincase, 21, 20.5; maxillary toothrow, 22, 21. For individual measurements see table below.

Remarks.—There can be but little doubt that *Urogale cylindrura* is perfectly synonymous with *U. everetti*. The relatively slight difference in color between the type of *U. everetti* and the Mount Apo specimens is due only to the fact that the former is an old specimen skinned out of alcohol,[1] while the latter are modern freshly prepared skins. There is almost as much difference between members of the Apo series as there is between the type of *U. everetti* and the Apo series as a whole. The skull and teeth of Zamboanga specimen are essentially like those from Mount Apo. The Mount Malindang specimen is represented by a skin brought back by Doctor Mearns in 1906. The information on the label reads: "Malindang Mts., summit of Mt. Bliss, 5,750 ft., June 3, 1906. Shot on trunk of an oak tree by Private D. W. West, Co. B, 19th Infantry, U. S. A." It has every appearance of having been preserved in alcohol or formalin at some time. Apparently the skull was not saved. A hind foot and tibia removed from the skin show it to be a young individual. It has the general color characters of *Urogale everetti* combined with the long sharp claws and *Tana*-like style of nose. The entire pelage, however, including that of the tail, is much longer and softer than it is in Mount Apo specimens. It is barely possible that it represents an entirely distinct species of *Urogale* or even another genus.

Specimens examined.—Nine. Seven from Mount Apo, one from Zamboanga, and one from Mount Malindang, the last doubtfully referable to the genus and species.

Measurements of Urogale everetti.

Locality.	Number.	Sex.	Molar teeth worn.	Head and body.	Tail.	Hind foot.	Condylobasal length.	Zygomatic width.	Width of brain case.	Maxillary tooth row.	Number of mammæ.
MINDANAO.				*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	
Mount Apo, 4,000 feet	125287 [2]	Male	Moderately	182	163	50	58.5	29	20.5	21	....
Do	125288	do	do	185	155	49	56.5	29	20	21	....
Mount Apo, 3,000 feet	7.2.2.1	do	Slightly	214	165	51	58	29	21	21.5	....
Do	7.2.2.2	do	do	197	148	49	58	30	21.5	21.5	....
Mount Apo, 4,000 feet	7.2.2.3	Female	None [3]	165	142	48	49.5	.....	20	20	....
Mount Apo, 3,000 feet	7.2.2.4	do	Slightly	202	150	48	55	27.5	20	20.5	2-2
Do	7.2.2.5	do	Moderately	200	147	49	58	29	21	21	2-2
Zamboanga	79.5.3.11 [4]	Male	do	235±	170±	51	58	29	21	22	....
Mount Malindang	144825	.....	.....	170±	115±	44	.....	.....	.....	.....	....

[1] See Thomas, Proc. Zool. Soc. London, 1907, p. 149.
[2] Type of *Urogale cylindrura* Mearns.
[3] m^3 just appearing.
[4] Type.

Genus PTILOCERCUS Gray.

1848. *Ptilocercus* GRAY, Proc. Zool. Soc. London, 1848, p. 23.
1864. *Ptilocerus*, BREHM, Ill. Thierl., vol. 1, pp. 663-665. A misspelling of *Ptilocercus*.
1876. *Ptilocerus*, WALLACE, Geographical Distribution of Animals, vol. 1, p. 337. A misspelling of *Ptilocercus*.

Type.—Ptilocercus lowii Gray,[1] the only species included in the genus.

Diagnosis.—An aberrant member of the family Tupaiidæ, forming the subfamily Ptilocercinæ, distinguished externally by its large thin ears, naked tail basally, distichously tufted distally, cranially by absence of supraorbital foramen, and approximately parallel temporal ridges; dentally by the relatively larger size of the first upper incisors over the second pair, double-rooted upper canine, without conspicuous diastema between second upper incisor and upper canine, and absence of mesostyles on upper molars.

External characters.—Ptilocercus differs very strikingly from any other members of the family Tupaiidæ in the form of its tail, which is naked and scaly for about its proximal half or a little more, and distichously tufted for a trifle less than the distal half. The extreme basal eighth of the tail is covered with soft furry hair like the adjacent parts of the body. Each scale of the naked portion of the tail is subtended by three short hairs about equal to a scale and a quarter or a scale and a half in length. The hands and feet of *Ptilocercus* are relatively larger than in the other genera of the family, and the footpads relatively larger, with an appearance of greater softness. The fifth finger is as large as the second, and relatively much larger than it is in *Tupaia*. The four interdigital pads are larger and more rounded; the thenar and hypothenar are relatively larger and situated at about the same anteroposterior level; posteriorly the two pads are connected by a slight bridge. Of the toes, the third, fourth, and fifth are equal and the second nearly as large. The first toe is well developed but much shorter than the others. Of the pads of hind foot, the interdigitals are large and rounded; the small pad accessory to the fourth interdigital is wanting. Corresponding to the relatively shorter foot the proximal external pad is relatively shorter than in *Tupaia*, and the proximal internal is much shorter and wider and perfectly distinct from the first interdigital pad. Mammæ, 2–2=4.

The ear of *Ptilocercus* is large, thin, and membranaceous in contrast to the small thick ear of *Tupaia*, with a fairly well developed tragus and a ridgelike antitragus. Viewed by the unaided eye, both inside and outside of the ear is essentially naked, but under a glass a few scattered hairs are found interiorly, and slightly more

[1] Proc. Zool. Soc. London, 1848, p. 23.

on the outer surface, gradually increasing in quantity toward the base, where the ear is as well furred as the body.

No shoulder stripe is present on *Ptilocercus*, but distinct markings are found on sides of head, consisting of a distinct black patch, almost a stripe, extending from near the tip of the nose, posteriorly through the eye a little more than half way to base of ear. This black patch is bordered above and below not by distinct light stripes, but by the rather light color of top of head and the distinctly light color of the underparts. At the beginning of the black face stripe arise well developed vibrissæ lacking in the Tupaiinæ. (Plate 7.)

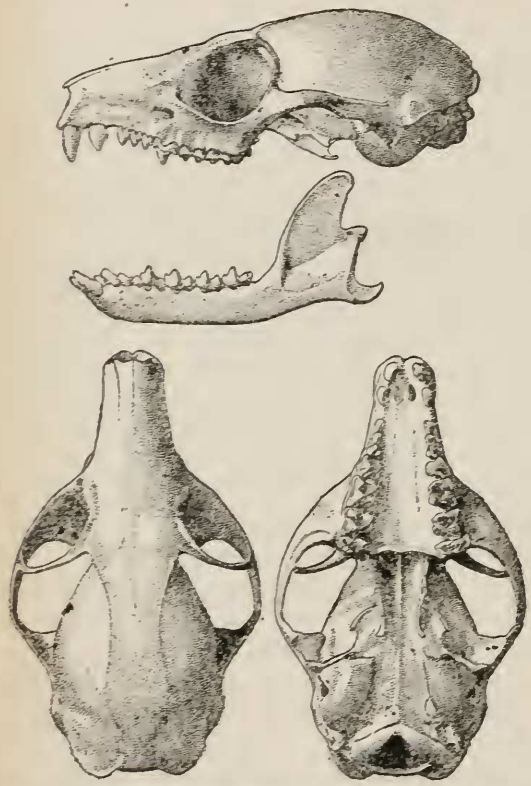


FIG. 14.—PTILOCERCUS LOWII CONTINENTIS, × 1½; CAT. NO. 112611, U.S.N.M., SEMBRONG RIVER, JOHORE, MALAY PENINSULA.

Cranial characters.—Some of the most fundamental differences between *Ptilocercus* and the other Tupaiidæ are found in the region of the orbit, certain structures in one having no direct counterpart in the other. *Tupaia* has a distinct supraorbital foramen, which is continued backward as a well-marked groove on the underside of the upper rim of the orbit. There is no counterpart of this foramen or groove in *Ptilocercus*. The infraorbital is a long canal in *Tupaia*, the proximal end in the orbit and the distal end of the canal over the penultinate upper premolar; in *Ptilocercus* the canal is much shorter and is situated over the middle of the last upper premolar. In the most anterior corner of the orbit is the posterior opening of another foramen leading into the nasal fossa. In *Tupaia* this opening is situated in a distinct notch, 2 mm. or so in size, and the upper end of this notch forms a distinct blunt spine. This notch and spine are entirely lacking in *Ptilocercus*. The position of the orbits in *Ptilocercus* is quite different from that in the Tupaiinæ. They are relatively larger, and placed relatively farther forward; the posterior

edge of the orbit is placed only a trifle behind the level of the union of olfactory bulb with the cerebrum, whereas in Tupaiinæ the posterior edge of the orbit is placed very much behind the level of the point of union of olfactory bulb and cerebrum. The general plane of the orbits in *Ptilocercus* looks more to the front of the animal, the plane of each orbit making with the long axis of the skull an angle of about 40°. In the case of Tupaiinæ the orbits look more to the side, each making with the long axis of the skull an angle of about 20°. Other conspicuous features about the skull of *Ptilocercus* are the wide spreading zygomata, temporal fossa larger than orbit, approximately parallel temporal ridges, a better ossified palate and simpler audital bullæ; that is, not divided by internal septa, as is frequently the case in the Tupaiinæ. The comparatively small antero-external segment of the bulla in *Tupaia* is very much reduced in *Ptilocercus*. At the apex of the orbital cavity in both *Tupaia* and *Ptilocercus* are two foramina, (1) the optic and (2) sphenoid fissure. In *Tupaia*, just below and external to these is the foramen rotundum, situated at the base of the external pterygoid plate, communicating with the cranial cavity as well as with a canal, the alisphenoid, running lengthwise in the base of the external pterygoid plate. In *Ptilocercus* the foramen rotundum is confluent with the sphenoidal fissure. Posterior to the external pterygoid plate in *Ptilocercus*, near the bulla, is a distinct oval foramen leading into the cranial cavity; this foramen is almost entirely overlapped by the bulla in *Tupaia*.

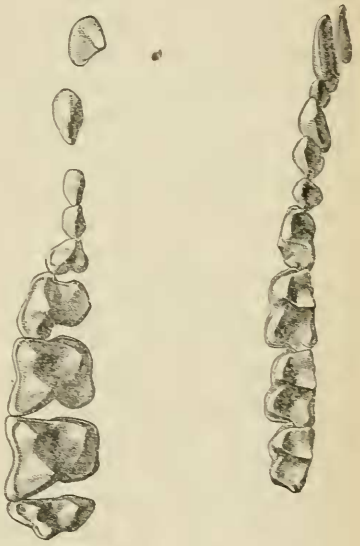


FIG. 15.—UPPER AND LOWER TOOTHROWS OF PTILOCERCUS LOWII CONTINENTIS, × 4; CAT. NO. 112611, U.S.N.M., SEMBRONG RIVER, JOHORE, MALAY PENINSULA.

The postorbital constriction in *Ptilocercus* is slightly less than the interorbital, being similar in this respect to *Urogale*. In *Tupaia* the postorbital constriction is greater than the interorbital. The two limbs of the lambdoid crest in *Ptilocercus* do not meet in a backwardly projecting obtuse angle as in Tupaiinæ, but each limb runs up to meet its corresponding temporal ridge. Between the posterior extremities of the temporal ridges the lambdoid exists as a slightly convex (backwardly) ridge.

The coronoid process of the mandible is relatively larger and wider in *Ptilocercus* than in *Tupaia*, and the notch between the condyle and coronoid shallower. See figure 14, page 160.

Dental characters.—There are not so many fundamental differences between the teeth of *Ptilocercus* and *Tupaia* as there are between the skulls, perhaps no more than generic differences. The upper canine is distinctly two-rooted and premolariform in shape. At times the upper canine in *Tupaia* is also two-rooted, but is not premolariform in shape. The first upper incisors are very much larger than the second pair, usually disproportionately more so than is usual in *Tupaia*. Both pairs of upper incisors are somewhat differently shaped in *Ptilocercus* and *Tupaia*. In the latter they are simple cone-like recurved teeth; in *Ptilocercus* these teeth are more trenchant with a moderately well-developed posterior cutting edge, and the second incisor almost has a distinct posterior cusp. Owing to the shortness of the rostrum, the incisor-canine-premolar series of teeth stand closer in the tooth row than they do in Tupaiinæ. The second upper premolar is three-rooted, as is usually the case in Tupaiinæ, and also is more triangular and more like the last upper premolar in shape. The last upper molar is more compressed antero-posteriorly in *Ptilocercus* than in *Tupaia*. The upper molars of *Ptilocercus* lack the mesostyle, which is quite conspicuous in Tupaiinæ; the cusps on the teeth appear blunter and more rounded. The molars are surrounded by a distinct cingulum, absent in *Tupaia*. In the lower jaw the first and third incisors are relatively smaller with respect to the second incisor in *Ptilocercus* than in *Tupaia*. The lower canines are about the same relative sizes in the two genera, but in *Ptilocercus* they are less canine-like in shape and look like enlarged first premolars. In *Ptilocercus* the middle lower premolar is much smaller than either of the two other premolars and is below the general level of the lower tooth row, while in *Tupaia* it is the first which is the smallest of the premolar series and which stands below the level of the tooth row. The lower molar teeth have a well-defined cingulum on their outer aspect, lacking in Tupaiinæ, but otherwise no essential differences are found in the two genera. See figure 15, page 161.

Geographic distribution.—*Ptilocercus* is found in Borneo, Banka, Sumatra, and Pulo Pinie of the Batu Islands, and in the southern part of the Malay Peninsula. It is said to exist on Sirhassen of the Natuna Islands.[1] See Nos. 2 and 3 on map, page 133.

Number of forms.—*Ptilocercus* contains but a single species group, *lowii*, of which one geographic race has been described.

Remarks.—*Ptilocercus* differs in external and particularly in cranical characters from any of the other genera of the Tupaiidæ more than any of them differs from each other, and seems well worthy of subfamily rank. The most striking differences are found in the ears, tail, feet, supraorbital foramen, and certain foramina at base of skull,

[1] See Thomas and Hartert, Nov. Zool., vol. 1, p. 656, September, 1894.

some of them having no counterpart in the other genera. Dentally it differs conspicuously from the other genera in lacking mesostyles on the upper molars and in having distinct cingula on both upper and lower molars.

PTILOCERCUS LOWII Gray.

(Synonymy, type-specimens, etc., under the subspecies.)

Geographic distribution.—The same as that of the genus, page 162.

Diagnosis.—The same as for the genus, page 159.

Color.—General color of upper part of head, neck, and body and outerside of legs, isabella color variously shaded with drab or drab-gray, top of head usually lighter, sides of body with a more or less distinct buff wash; underparts including innerside of legs varying from gray to a rather dark buff, the latter more conspicuous anteriorly; a black or blackish mark extending posteriorly through the eye, but not reaching base of ear, the black mark contrasting strongly with the lighter colors of the head; distal portion (75–80 mm.) of plume of tail, white or cream color, proximal portion (about 10 mm.) blackish brown; the well-haired basal portion of the tail colored like adjacent parts of body. (See Plate 7.)

Skull and teeth.—The same as for the genus, pages 160 to 162.

Remarks.—*Ptilocercus lowii* is one of the most strongly characterized of mammals and can be instantly identified by its external as well as cranial characters. It is quite rare in collections. Dr. W. L. Abbott has collected over 6,000 mammals in regions where it is known or supposed to occur, and has only encountered it twice. I have seen 10 examples of the pentailed treeshrew, and know of two others in the Leyden Museum which I have not seen. *Ptilocercus* and *Dendrogale* seem to be of about equal rarity, at least in collections. This probably is due not so much as an actual rarity in nature as to some peculiarity of habit, rendering them seldom observed and difficult to trap. Observations on the habits of this animal are scarce. Both of Doctor Abbott's specimens were caught in traps in heavily forested hills. The Selangor [1] specimen was "captured in its nest in a hollow bough. * * * The nest was merely a tunnel about 3 inches in diameter and 18 inches in length, roughly lined with fibrous material and green leaves." The original representative was caught in a house. Schneider's [2] remarks are interesting and worth quoting in full:

> The natives did not know this little animal and simply called it, in response to my questions, Tikuskaju—that is, Treemouse. The male of this pentailed treeshrew happened to be brought alive to me by a Battak man employed in the vicinity in woodcutting. Thereupon I hastened at once with the man to the exact spot where he had obtained it, in the hope of perhaps yet capturing the female, and my joy wac

[1] Robinson, Journ. Straits Brit. Royal Asiat. Soc., No. 44, 1905, p. 225.

[2] Zool. Jahrb., vol. 23. pt. 1, 1905, p. 84.

indescribable when after a quarter hour I had the luck to discover the female in the leafy summit of a large tree lying on the ground, amongst the parasitic vegetation which thickly covered the tree, and to capture it with the help of the woodcutters. I then kept the pair alive for several hours in order to observe them. The long pentail they carried hanging or lightly outstretched, and at the same time they constantly moved it to and fro like the pendulum of a clock. It appeared to me as if they used the tail as an organ of touch. If I merely touched lightly the hairs of the plume with my finger, they moved away, but they permitted themselves to be gently stroked and handled without making an attempt to bite. They sniffed the bananas which I laid before them, but they did not eat any. As I feared through some accident these rare and interesting little animals might escape from me, I chloroformed them at evening, measured them at once, and preserved them in alcohol.

Of this pair the male is preserved in the Natural History Museum at Basel and the female at Strassburg.

Subspecies.—Two forms of *Ptilocercus lowii* have thus far been recognized, true *lowii* on Borneo, and *continentis* from the Malay Peninsula. The specimen from Banka is probably the same form as the Bornean one. The Sumatran and Batu specimens are here regarded as the same as the peninsular form. The two subspecies are not highly differentiated from one another, and it would be well if their distinctness could be established by the examination of more material or the examination of all the known examples together. The only material that I have carefully examined is that in the United States National and British Museums.

KEY TO THE SUBSPECIES OF PTILOCERCUS LOWII.

Toes not different in color from rest of hind foot; muzzle and palate slightly broader. Borneo, Banka; *P. lowii lowii*, p. 164.

Toes distinctly lighter in color than rest of hind foot; muzzle and palate slightly narrower. Malay Peninsula, Sumatra, Batu Islands ----*P. lowii continentis*, p. 165.

PTILOCERCUS LOWII LOWII Gray.

1848. *Ptilocercus lowii* GRAY, Proc. Zool. Soc. London, 1848, p. 23, pl., mammalia, 2, entire animal in colors, very good.

1848. *Ptilocercus lowii*, GRAY, Ann. Mag. Nat. Hist., ser. 2, vol. 2, p. 212, September, 1848. The same account as appeared in Proc. Zool. Soc. London, 1848.

1850. *Ptilocercus lowii*, GRAY, Zool. Voy. Samarang, p. 18, pl. 5, entire animal in colors, and views of skull and teeth.

Type-locality.—Sarawak (the town), northern Borneo.

Type-specimen.—In British Museum, mounted skin, Reg. No. 47.12.30.1, and skull, Reg. No. 48.5.12.3, collected in the Rajah's house, Sarawak, Borneo, by Mr. Hugh Low. The mounted skin is very old and exhibition worn, and was probably made from an alcoholic specimen; considerable patches of hair have slipped from the left side and from belly. The skull is perfect and in good condition, but is not fully adult, as the deciduous incisors are still retained.

Geographic distribution.—Northern Borneo, Sarawak, Baram River, Lawas Mountains,[1] islands of Banka, and Sirhassen.[2] See No. 2 on map on page 133.

Diagnosis.—Toes not distinctly lighter than rest of hind foot, and skull with broader muzzle and palate, teeth slightly larger, general coloration a clearer isabella color, with less tendency to drab or drab gray.

Measurements.—Type: Head and body (from mounted skin) 140 mm., tail (from mounted skin) 160; hind foot, 27; condylo-basal length, 35; zygomatic width, 20.5; width of braincase, 14.5; maxillary toothrow, 14. Usual measurements of adults: Head and body, 135–150; tail, 160–180; hind foot, 27–28; condylo-basal length, 37–38; zygomatic width, 22–23; width of braincase, 14.5–15; maxillary toothrow, 13–14.

Remarks.—Jentink[3] records in the Leyden Museum a specimen of *Ptilocercus* from Banka, a mounted skin and incomplete skull of a nearly adult animal. Owing to the general similarity of the mammals of Banka and Borneo, this specimen is here regarded as belonging to the typical subspecies.

Specimens examined.—Five. See table, page 166.

PTILOCERCUS LOWII CONTINENTIS Thomas.

1910. *Ptilocercus lowi continentis* THOMAS, Ann. Mag. Nat. Hist., ser. 8, vol. 5, May, 1910.

Type-locality.—Vicinity of Kwala Lumpur, Selangor, Malay Peninsula.

Type-specimen.—In British Museum, Reg. No. 10.4.17.1, skin and skull of an adult male, collected 10 miles from Kwala Lumpur, Selangor, December 27, 1903, by a Dyak collector employed by Selangor Museum; in good condition.

Geographic distribution.—At present known from Selangor and Johore of the Malay Peninsula, Deli-Lankat region of Sumatra, and Pulo Pinie of the Batu Islands off west coast of Sumatra. See No. 3 on map on page 133.

Diagnosis.—Differs from *Ptilocercus lowii lowii* in having more drab in the colors of the upper parts, the metatarsal region of hind feet brown in contrast with the lighter toes, and in the possession of a somewhat narrower rostrum and palate, and slightly smaller teeth. (See Plate 10, fig. 5.)

Measurements.—Type: Head and body, 133 mm.; tail, 167; hind foot, 28; condylo-basal length, 27; zygomatic width, 22.5; width of brain case, 15; maxillary tooth row, 12.5. For individual measurements see table, page 166.

[1] See Hose, Mammals of Borneo, 1893, p. 34.

[2] See Thomas and Hartert, Nov. Zool., vol. 1, 1894, p. 656.

[3] Cat. Mus. Hist. Nat. Pays-Bas, Osteol. Mamm., vol. 9, 1887, p. 242; Cat. Mus. Hist. Nat. Pays-Bas, Mamm., vol. 12, 1888, p. 118.

Remarks.—The chief distinguishing mark of this subspecies is the brown color of the metatarsal region of the foot in contrast with the buff-colored toes. The differences pointed out by Mr. Thomas in regard to the "naked portion" of the tail is simply due to the manner in which the skin of the tail of the type is stretched. This animal was first recorded on the Malay Peninsula by Mr. Robinson in 1905.[1] Although the Selangor specimen was the first to be recorded in the literature, Dr. W. L. Abbott was the first person to take *Ptilocercus* on the Asiatic Continent, his Johore specimen being collected July 5, 1901, about two and a half years before the Selangor animal was secured.

Specimens examined.—Two from the Malay Peninsula, one from Pulo Pinie. The two Sumatran specimens I merely saw in their exhibition cases without critically examining them. See table below. In addition to these a skeleton of a specimen collected at Deli Sumatra is recorded by Jentink.[2]

Measurements of Ptilocercus lowii.

Name.	Locality.	Number.	Sex.	Molar teeth worn.	Head and body.	Tail.	Hind foot.	Condylo-basal length.	Zygomatic width.	Width of brain case.	Maxillary tooth row.	Number of mammæ.
					mm	*mm*	*mm*	*mm*	*mm*	*mm*	*mm*	
Ptl. lowii continentis.	Johore, Sembrong River.	112611	Male	Moderately	143	165	28	36	22	15	12.5	....
Do	Selangore, Kuala Lumpur.	10.4.17.1 [3]	...do	Slightly	133	167	28	37	22.5	15	12.5	....
Do	Batu Islands, Pulo Pinie.	121855	...do	Moderately	140	170	29	35.5	21.5	14	13	....
Do	Sumatra, Lower Langkat.	Basel, 1246.	...do	Adult [4]	120	170	30	....	....	....	....	....
Do	....do	Strassburg.	Female.	...do. [5]	120	170	30	....	....	....	....	....
Ptl. lowii lowii	Borneo	Paris, 1225 [6]			170±	150±	34±	....	....	....	....	....
Do	....do	Berlin, 3992		Very slightly.	150±	180±	28±	38	22	15	13.5	....
Do	Borneo, Sarawak.	$\frac{47.1.2.3.9.1}{48.12.3}$ [7]		None [8]	140	160	27	35	20.5	14.5	14.0	....
Do	Borneo, opposite Labuan.	76.5.2.8	Male	Slightly	135±	180±	28	37.5	23	15	13	....
Do	Borneo, Labuan [9].	89.1.9.1 [10]	Female.	...do	140	180	28	37.5	22.5	14.5	13	2–2

[1] Journ. Straits Branch Royal Asiat. Soc., No. 44, 1905, p. 225.
[2] Notes Leyden Museum, vol. 7, 1885, p. 38, and Cat. Mus. Hist. Nat. Pays-Bas. Osteol. Mamm., vol. 9, 1887, p. 242.
[3] Type.
[4] Entire specimen in alcohol on exhibit; measurements furnished by collector.
[5] Skin, mounted from alcoholic, and entire body in alcohol, on exhibit; measurements furnished by collector.
[6] Mounted.
[7] Type, mounted.
[8] Deciduous incisors still in place.
[9] Although labeled Labuan I suspect the specimen came from the mainland opposite.
[10] Preserved in alcohol.

BIBLIOGRAPHY.

This bibliography contains a list of all the works which I have consulted in preparing this paper, and in addition many titles of papers in which reference is made to treeshrews, often in a rather subordinate way. I believe that it contains all the important works bearing on the subject, but necessarily does not contain every reference to treeshrews in literature. Certain publications which I have seen referred to as probably mentioning the family, I have been unable to find, and of course there must be many numerous minor articles or references which I have not encountered.

ALLEN, J. A. The Geographical Distribution of the Mammalia considered in relation to the principal ontological regions of the earth, and the laws that govern the distribution of animal life. Bull. U. S. Geol. Geogr. Surv. Terr., vol. 4, 1878, pp. 313–378.

Tupaia, one of the characteristic mammals of the Indian Region.

———. Mammals from the Island of Hainan, China. Bull. Amer. Mus. Nat. Hist., vol. 22, pp. 463–490, December 17, 1906.

Original description of *Tupaia modesta*.

———. Mammals from Palawan Island, Philippine Islands. Bull. Amer. Mus. Nat Hist., vol. 28, pp. 13–17, January 29, 1910.

Records the specimen of *Tupaia* from Palawan in the American Museum of Natural History, on page 17, as *T. ferruginea palawanensis*.

ANDERSON, JOHN. On the osteology and dentition of *Hylomys*. Trans. Zool. Soc. London, vol. 8, 1874, pp. 453–467, plate 1.

Shows that affinities of *Hylomys* are with *Erinaceus* and *Gymnura* and not with *Tupaia*.

———. Anatomical and Zoological Researches: Comprising an account of the Zoological Results of the two Expeditions to Western Yunnan in 1868 and 1875, vol. 1, text, and vol. 2, plates, 1879.

Pages 107–137, a very excellent anatomical and systematic account of the Tupaiidæ with numerous bibliographic references. Genus *Dendrogale, D. murina, D. frenata;* Genus *Tupaia, T. ellioti, T. belangeri, T. chinensis,* new; *T. ferruginea; T. splendidula, T. javanica, T. malaccana,* new; *T. tana, T. nicobarica.* Plate 7, dorsal and lateral views of skulls of all.

———. Catalogue of Mammalia in the Indian Museum, Calcutta, pt. 1, 1881, pp. 153–157.

Lists, often with exact localities, *Tupaia ellioti, belangeri, chinensis, ferruginea, malaccana, tana, nicobarica.*

BALL, V. On the occurrence of *Tupaia Ellioti*, Waterhouse, in the Satpura Hills, Central Provinces. Proc. Asiat. Soc., Bengal, 1874, pp. 95–96.

Records *Tupaia ellioti* from Satpura Hills (=*Anathana wroughtoni* of this paper).

BARTHOLOMEW, J. G., CLARKE, W. EAGLE, and GRIMSHAW, PERCY H. Atlas of Zoogeography=vol. 5, Bartholomew's Physical Atlas, 1911.

Page 15, plate 4, map 4. Remarks on and map of the geographic distribution of the Tupaiidæ, 34 species recognized, but none named.

BEDDARD, FRANK EVERS. Mammalia. Cambridge Natural History, vol. 10, 1902.

Brief account of the family Tupaiidæ, with the genera *Tupaia* and *Ptilocercus* on p. 511.

BLAINVILLE, H. M. DUEROTAYDE. Ostéographie des Mammifères Insectivores, pp. 31–35. Ostéographie ou Description Iconographique comparée du Squelette et du Système dentaire des cinq classes d'Animaux Vertébrés, 1840.

Account of the osteology, uses the generic terms *Glisorex* and *Cladobates*, pl. 3, lower figures, and in table of plates uses the combination *Erinaceus* (*Glisorex*) *tana*.

BLANFORD, W. T. Fauna of British India, including Ceylon and Burma, Mammalia, 1888, Tupaiidæ, pp. 207–212.
General account of family, genus, and species *ellioti, ferruginea, nicobarica*, quoted accounts of habits, etc.

BLYTH, E. Cuvier's Animal Kingdom, etc., London, 1840, pp. 78 and 79.
A brief account of the genus *Tupaia*, with included species *T. tana, sumatrana*, and *ferruginea*. *Sumatrana* occurs as a new name, and is a *nomen nudum*.

———. Catalogue of Mammalia in the Museum Asiatic Society, Calcutta, 1863. pp. 81–82.
Lists a few specimens and mentions *T. ellioti* as questionably occurring in Ceylon.

———. Catalogue of Mammals and Birds of Burma. Journ. Asiat. Soc. Bengal, part 2, Extra Number, August, 1875, pp. 31, 32.
Describes *T. belangeri* and quotes authors on habits.

BOAS, J. E. V. Ohrknorpel und Äusseres Ohr der Säugetiere, 1912, pp. 60–61, pl. 3, fig. 27.
Description and figure of the ear cartilage of *Tupaia tana* (=*Tana tana*).

BONAPARTE, C. L. Vertebratorum Systematis. Nuov. Ann. Sci. Nat. Bologna, vol. 2, 1838, p. 113.
Uses the name Cladobatidina as a group of the Soricidæ.

——— Prodromus Systematis Mastozoologiæ. Nuov. Ann. Sci. Nat. Bologna, vol. 3, 1840.

——— Catalogo Metodico dei Mammiferi Europei, pp. 1–35, 1845.
On p. 5 uses Cladobatina as a subfamily of Soricidæ.

BONHOTE, J. LEWIS. On a collection of Mammals from Siam made by Mr. T. H. Lyle. Proc. Zool. Soc. London, 1900, pp. 191–195.
Records *Tupaia belangeri* from Nan and Chengmai. In this paper these specimens are identified as *T. chinensis*.

——— On the Mammals collected during the "Skeat Expedition" to the Malay Peninsula, 1899–1900. Proc. Zool. Soc. London, 1900, pp. 869–883.
Tupaia ferruginea from Belimbing Kelantan, Gunong Inas, Kota Bhara. Good lists of localities.

——— Fasciculi Malayenses. Zool., vol. 1, 1903, pp. 1–45.
Records *Tupaia belangeri* from Biserat, and *T. malaccana* from Perak-Pahang boundary.

——— On Mammals from South Johore and Singapore collected by Mr. C. B. Kloss. Proc. Zool. Soc. London, 1906, pp. 4–11.
Tupaia ferruginea, T. malaccana.

———[Original Description of *Tupaia concolor*.] Abstr. Proc. Zool. Soc. London, 1907, p. 2, January 22, 1907.

——— On a Collection of Mammals made by Mr. Vassel in Annam. Proc. Zool. Soc. London, 1907, pp. 3–11, pl. 2.
Tupaia concolor, Dendrogale frenata.

——— Report on the Mammals, pt. 1 of Report on the Gunong Tahan Expedition, May–September, 1905. Journ. Fed. Malay States Mus., vol. 3, 1909.
Tupaia ferruginea recorded from Gunong Tahan, 3, 300 feet, and Pahang River.

BOURNS, FRANK S., and WORCESTER, DEAN C. Preliminary Notes of the Birds and Mammals collected by the Menage Scientific Expedition to the Philippine Islands. Occ. Papers Minn. Acad. Nat. Sci., vol. 1, No. 1, pp. 1–64, 1894.
On p. 61, *Tupaia javanica*, recorded on Palawan, Calamianes. Probably misidentification of *T. palawanensis* and *T. möllendorffi*.

BREHM, A. E. Illustrirtes Thierleben, 1864, vol. 1, pp. 663–665.
Cladobates tana, C. ferrugineus, Ptilocerus (sic) *lowii*, not very good wood cuts of the three forms.

——— Die Säugethiere, 1877, vol. 2, pp. 223, 224.
Cladobates tana. (*Sorex glis, Tupaya*, and *Hylogalea ferruginea* apparently considered synonymous with it.) A fair wood cut of *Tana* which is copied by Gill and by Dallas. *Ptilocercus* not mentioned.

CANTOR, T. Catalogue of Mammalia inhabiting the Malayan Peninsula and Islands. Journ. Asiat. Soc. Bengal, vol. 15, 1846, pp. 188–190.
Remarks on habits, young, mammæ, and cecum (⅛ in. long) of *Tupaia*.

CARUS, J. V. Handbuch der Zoologie, 1868–75, p. 89.
Brief account of *Tupajæ: Cladobates, Dendrogale, Ptilocercus, Hylomys*.

CHAPMAN, HENRY C. Observations on *Tupaia*, with reflections on the origin of Primates. Proc. Acad. Nat. Sci. Phila., 1904, pp. 148–156.
Observations on the anatomy of cecum, stomach, and liver of *Tupaia ferruginea* and *T. pictum*. Cecum said to be absent.

CUVIER, FRÉDÉRIC. Des Dents des Mammifères considérées comme caractères zoologiques, pp. i–lv, and 1–259, pls. 1–103, 1825.
First use of the term *Cladobates*, pp. 60–61, and descriptions, and illustrations of teeth of [*Cladobates*] *tana, ferruginea, javanica*.

———. Table Générale et Méthodique at end of Hist. Nat. Mamm., vol. 7, dated 1842.
106 Cerp ou Banxring (*Cladobates javanica*), 107 Press (*Cladobates ferruginea*).

CUVIER, GEORGES. Règne Animal, vol. 1, 1829, pp. 125–126.
The genus *Cladobates* or *Tupaia* briefly mentioned with the included species *javanica, tana, ferruginea*,

———. Leçons d'Anatomie Comparée, ed. 2, vol. 2, 1837.
In article on osteology of the skull much scattered information regarding *Cladobates*.

DALLAS, W. S. Insectivora. Cassel's Natural History, vol. 1 (1880?).
A compiled account of the family; genera: *Tupaia, Dendrogale, Ptilocercus, Hylomys* (sic), pp 347–350. Woodcut of *Tana chrysura* after Günther.

DESMAREST, A. G. Mammalogie ou Description des Espèces de Mammifères, vol. 2, supplement, 1822, pp. 535–536.
Proposes the generic name *Glisorex*, but adopts *Tupaia: T. tana, javanica, ferruginea*.

DIARD. Report of a meeting of the Asiatic Society of Bengal for March 10, 1820. Asiat. Journ. Month. Reg., vol. 10, pp. 477–478, November, 1820.
The first published account of a treeshrew and original description of *Sorex glis* (= *Tupaia glis glis*) from Penang.

DIARD and DUVAUCEL. On the *Sorex Glis*, communicated by Major General Hardwicke. Notice.—Sur une nouvelle espèce de *Sorex.—Sorex Glis*. Asiat. Res., vol. 14, 1822, p. 472, pl. 9.
A republication of the preceding article.

DORAN, ALBAN H. G. Morphology of the Mammalian *Ossicula auditus*. Trans. Linn. Soc. London, ser. 2, vol. 1, 1879, August, 1878, pp. 371–497, pls. 58–64.
On p. 441 and following, description of auditory ossicles of *Tupaia*, and illustrated on pl. 62, fig. 17.

ELERA, CASTRO DE. Catalogo Sistemática de toda la Fauna de Filipinas, etc., vol. 1, 1895, p. 17.
Tupaia ferruginea recorded from Culion (probably= *T. möllendorffi*), Paragua (probably= *T. palawanensis*), Java, Sumatra, Borneo, Singapore, Malacca; and *T. javanica* from Calamianes, Culion (probably= *T. möllendorffi*, Paragua (probably= *T. palawanensis*), Borneo, Java, Sumatra.

ELLIOT, DANIEL GIRARD. A Catalogue of the Collection of Mammals in the Field Columbian Museum. Field Columbian Museum, Pub. No. 115, Zool. Ser., vol. 8, 1907.
On p. 464, *Tupaia tana*, one specimen from "Sumatra."

ELLIS, WILLIAM. Manuscript Journal and drawings of animals observed during Capt. Cook's third voyage, 1780. In Library of British Museum (Natural History).
Description and colored illustration of *Tupaia dissimilis*. The description published by Gray, Ann. Mag. Nat. Hist., ser. 3, vol. 5, 1860, p. 71. A copy of Ellis's colored drawing forms Plate 1 of this paper.

———. Voyage of Capt. Cook and Capt. Clerke in Ships *Resolution* and *Discovery*, 1776, 1777, 1778, 1779, and 1780, published 1782.
On page 340 of vol. 2 the treeshrews of Pulo Condore are referred to as squirrels

EVERETT, A. H. A list of the Birds of the Bornean Group of Islands. Journ. Straits Branch, Royal Asiat. Soc., No. 20, 1889, pp. 91–212.

Map of Borneo showing roughly the distribution of highlands and lowlands, with collector's localities marked in red; map of Palawan and adjacent islands.

———. Remarks on the Zoo-geographical Relationships of the Island of Palawan and some adjacent Islands. Proc. Zool. Soc. London, 1889, pp. 220–228, pl. 23, map showing sea depths.

On. p. 223 mentions *Tupaia javanica* and *ferruginea* as occurring on both Borneo and the Palawan group.

———. A Nominal List of the Mammals inhabiting the Bornean Group of Islands. Proc. Zool. Soc. London, 1893, pp. 492–496.

On p. 495, a list of the Bornean Tupaiidæ.

———. In Thomas and Hartert, Nov. Zool., vol. 1, p. 656, September, 1894.

Records *Ptilocercus* on Sirhassen, Natuna Islands.

FISCHER, J. B. Synopsis Mammalium, 1829.

Pages 259–260, describes *Tupaia* (mentioning four other terms that had been proposed) and three species *tana, javanica, ferruginea.*

FITZINGER, LEOP. JOS. Die Ausbeute der österreichischen Naturforscher an Säugethieren und Reptilien während der Weltumsegelung Sr. Majestät Fregatte *Novara.* Sitz. Akad. Wiss. Math. Nat. Wien, vol. 42, year 1860, p. 392.

Cladobates nicobaricus nomen nudum.

———. Die natürliche Familie der Spitzhörnchen (Cladobatæ). Sitz. Akad. Wiss. Math. Nat. Wien, vol. 60, 1869, pt. 1, pp. 263–289.

A systematic account of the family, in which Fitzinger included the genus *Hylomys: Cladobates tana, speciosus, ferrugincus, belangeri, ellioti, nicobaricus, javanicus, Dendrogale murina, Ptilocercus lowii.*

FLOWER, STANLEY SMYTH. On the Mammalia of Siam and the Malay Peninsula. Proc. Zool. Soc. London, 1900, pp. 306–379.

Tupaia ferruginea, ranging from Nepal to Java (embraces many forms), *T. javanica,* from Peninsula to Java (embraces many forms). Good lists of geographic localities.

FLOWER, W. H. Mammalia, pp. 347–446. Encylc. Brit., 9th ed., vol. 15, 1883.

Tupaiidæ, p. 401.

———. An Introduction to the Osteology of the Mammalia, 1885.

Tupaia treated nowhere as a whole, but most of the essential osteological characters pointed out at various places in the work.

FLOWER and LYDEKKER. An Introduction to the Study of Mammals Living and Extinct, 1891.

Pages 617 and 618 devoted to Tupaiidæ, two genera recognized, *Ptilocercus* and *Tupaia.* Figure of *Ptilocercus* after Gray.

GARROD, A. H. Notes on the Visceral Anatomy of the Tupaia of Burmah (*Tupaia belangeri*). Proc. Zool. Soc. London, 1879, pp. 301–305, figs. 1–3 of the brain.

A brief account of the visceral anatomy of a specimen that lived in the garden of the Society from February 8, 1875, to December 18, 1876, with observations on the anatomy of *Tupaia tana* and *T. splendidula.*

GEOFROY ST. HILAIRE, ETIENNE. Dictionnaire des Sciences Naturelle Strasbourg, Paris, 1828, vol. 56, p. 77. Article Tupai.

Genus called *Tupaia* Raffles, *Cladobates* F. Cuvier, latter apparently preferred.

Species.—Java: Le Banxrings; *C. javanica,* F. Cuv., Hist. Nat. Mamm., liv. 35. Sumatra: Le Tana; *C. tana* Raffl., Tran. linn., t. 13. Le Press; *C. ferruginea* Raffl., *Prcss,* F. Cuv., Hist. Nat. Mamm. liv. 36.

GEOFFROY ST. HILAIRE, ISADORE. In Belanger, Voyage aux Indes-Orientales, Zoologie, 1835. Text, pp. 103–107, and Atlas, pl. 4.

Original description of *Tupaia belangeri,* and rather poor colored illustrations of same.

GEOFFROY-SAINT HILAIRE and CUVIER, FRÉDÉRIC. Hist. Nat. Mamm., vol. 3, livr. 35, Cerp ou Banxring, dated December, 1821. Description of *Sorex-Glis Javanica* (Horsfield) and fair colored plate; first use of *Sorex-Glis* as a generic term; livr. 36. Le Press, dated January, 1822. Description of and fair colored plate of *Tupaya ferruginea* Raffles.

GERVAIS, PAUL. Histoire Naturelle des Mammifères, vol. 1, 1854, pp. 226–229.

Tupaia ferruginea, tana, javanica, murina, ellioti, peguana, Ptilocercus lowii. Figures of skull and teeth of *T. ferruginea*, external appearance of same, of *T. murina*, and of *Ptilocercus*, all in black and white.

GIEBEL, C. G. Die Säugethiere, 1855, pp. 913–915.

A brief review of the Tupaiidæ as known at the time of publication. *Cladobates murinus, tana ferrugineus, ellioti, javanicus, Ptilocercus lowi.*

——— Odontographie, p. 18, pl. 5, figs. 6 and 15–18, 1855.

Descriptions of teeth, illustrations, copied evidently from Horsfield and Owen; and original publication of *Glisosorex.*

GILL, THEODORE. Arrangement of the Families of Mammals. Smiths. Misc. Coll. No. 230, November, 1872.

On page 19, Tupayidæ given as the 91st family. No included genera.

——— Synopsis of Insectivorous Mammals. Bull. Geol. Geogr. Surv. Terr., No. 2, ser. 2, May 14, 1875.

On page 21, group Tupaioidea, fam. Tupaiidæ, genera *Tupaia* (including *Dendrogale*) and *Ptilocercus.*

——— Article Insectivora. The Standard Natural History, 1886, pp. 134–158.

A general account of the family on p. 141 (compiled), and wood cut of *Tana* opposite p. 148.

GRAY, JOHN EDWARD. An outline of an attempt at the disposition of Mammalia into Tribes and Families, with a list of the genera apparently belonging to each tribe. Ann. of Philos., new ser., vol. 10=Thomson's Ann. Philos., vol. 26, 1825, p. 339.

Tupaina as a subfamily of Talpidæ.

——— List of the Specimens of Mammalia in the collection of the British Museum. 1843, pp. 76–77.

Eight specimens listed, 3 species: *Tupaia tana, T. javanica, T. ferruginea.*

——— Description of a new genus of Insectivorous Mammalia, or Talpidæ, from Borneo. Proc. Zool. Soc. London, 1848, pp. 23–24, pl. 2, in colors; very good.

Original description of the genus and species *Ptilocercus lowii*, and remarks on treeshrews in general; original description of the genus *Dendrogale.*

——— Description of a new genus of Insectivorous Mammalia, or Talpidæ, from Borneo. Ann. Mag. Nat. Hist., ser. 2, vol. 2, p. 212, September, 1848.

A republication of preceding account.

——— Vertebrata. Zool. Voyage H. M. S. *Samarang*, pp. 18–20, 1850.

Detailed account of *Ptilocercus*, and summary of the other genera and species, *Tupaia javanica, ferruginea, tana, Dendrogale murina*, and *Ptilocercus lowii.* Entire animal in colors, and skull and teeth on plate 5.

——— Early notice of the *Tapaia* (sic) found in Pulo Condore. Ann. Mag. Nat. Hist., ser. 3, vol. 5, 1860, p. 71.

Original publication of W. Ellis's account of "*Sciurus dissimilis*" (= *Tupaia dissimilis*).

——— Ann. Mag. Nat. Hist., ser. 3, vol. 6, p. 217, August, 1860.

Original description of *Tupaia frenata.*

——— Notice of a species of *Tupaia* from Borneo in the collection of the British Museum. Proc. Zool. Soc. London, 1865, p. 322, pl. 12.

Original description of *Tupaia splendidula*, and a fairly good colored plate.

GREGORY, W. K. The Orders of Mammals. Bull. Amer. Mus. Nat. Hist., vol. 27. 1910.

Pages 269–280, a detailed consideration of the family Tupaiidæ. Two genera recognized: *Tupaia, Ptilocercus*, illustrations of the feet and skeleton of *Tupaia*, and of skull of *Ptilocercus.* Special attention is paid to affinities of the family, structure of teeth, and anatomy of skull.

GRIFFITH, E. Animal Kingdom, vol. 2, 1827, pp. 211–216.

A rather vague account of the genus *Tupaia* and the species *tana, javanica,* and *ferruginca;* a better account, vol. 5, p. 106, and there occurs this combination, *Tupaia Tanaia Tana,* ascribed to Raffles. Evidently a misprint, as the combination is not found in Raffles.

GÜNTHER, A. Remarks on some Indian and more especially Bornean Mammals. Proc. Zool. Soc. London, 1876, pp. 424–428, pl. 36, *Tupaia tana* var. *chrysura* in colors.

A review of the genus based on the specimens in the British Museum; 12 forms recognized, and *Tana chrysura* characterized for first time.

HAECKEL, ERNST. Systematische Phylogenie der Wirbelthiere, vol. 3, 1895.

On p. 582 uses *Cladobatida* as a group name for the treeshrews.

HARDWICKE, THOMAS. [Introductory Remarks.] On the *Sorex Glis.* Trans. Asiat. Soc. Bengal, vol. 14, 1822, pp. 471–472. See Diard and Duvaucel, on page 169.

Observations on habits.

HEILPRIN, ANGELO. The Geographical and Geological Distribution of Animals, 1887.

On p. 345, Tupaiidæ (genera *Tupaia, Ptilocercus*) briefly mentioned as inhabitants of Oriental Region.

HOLLISTER, N. A List of the Mammals of the Philippine Islands, exclusive of the Cetacea. Philippine Journ. Sci., vol. 7, No. 1, pp. 1–64, February, 1912.

A list of the Tupaiidæ in the Philippine Islands, pp. 6–7.

HORSFIELD, THOMAS. Zoological Researches in Java and the neighboring islands, 1824.

An account of the members of the genus *Tupaia* known at that time: *T. ferruginea, T. tana,* and *T. javanica* new. Rather poorly colored illustrations of the latter two, and a plate in black and white showing head and teeth of the three forms, and feet *T. tana* and *javanica.*

———. Plantæ Javanicæ Rariores, 1838–1842.

Contains an excellent old-time map of Java, showing Horsfield's journeys in Java, and map with p. v of postscript enables one to determine location of type-locality of *Tupaia javanica.*

———. Catalogue of Mammalia in the Museum of the Hon. East India Company, 1851.

On pp. 130–134 lists all the then known species of *Tupaia: javanica, ferruginea, tana, murina, peguana, belangeri,* and gives a very clear summary of the history, discovery, and habits of the animals. Examples only of the first two in the museum.

HOSE, CHARLES. Mammals of Borneo, 1893.

A good list of all of the Bornean forms of the family Tupaiidæ, the descriptive matter mostly compiled, but some good original notes. Forms mentioned: *T. javanica, longipes, tana, minor, dorsalis, splendidula, picta, montana, melanura, gracilis, D. murina, P. lowii.*

HUBRECHT, A. A. W. Ueber die Entwicklelung der Placenta von Tarsius und Tupaja nebst Bermerkungen ueber deren Bedeutung als haematopoietische Organe. Proc. Fourth Internat. Cong. Zool., 1899, pp. 343–382, pls. 4–15.

HUSCHKE. Ueber die Zähne von Cladobates. Isis, vol. 20, 1827, pp. 758–759. pl. 10.

A rather good description of the teeth of *Tupaia* and in comparison with *Sorex, Talpa, Erinaceus,* and *Chrysochloris.*

HUXLEY, THOMAS H. A Manual of the Anatomy of Vertebrated Animals, 1872.

On pp. 383, 384, a few facts about anatomy and osteology of the treeshrews, which are designated Tupayæ.

INGERSOLL, E. Life of Animals (Mammals), 1906, p. 75.

Barely mentions *Tupaias* and their distribution, but referring to their resemblance to squirrels says: "This has often been adduced as a case of 'mimicry,' which is very rare among mammals; but it seems to me rather an instance of 'convergence'—that is, the result of two animals coming to be like one another, because they have followed the same manner of life under identical circumstances."

JENTINK, F. A. On some rare and interesting mammals. Notes Leyden Museum, vol. 7, p. 37, 1885.

Mentions occurrence of *Ptilocercus* on Sumatra and Banka and makes a few remarks on the skeleton.

———. Catalogue Ostéologique de Mammifères. Mus. Hist. Nat. Pays-Bas., vol. 9, 1887.

List of the osteological material of the family Tupaiidæ in the Leyden Museum, pp. 240–242.

JENTINK, F. A. Catalogue Systématique des Mammifères. Mus. Hist. Nat. Pays-Bas., vol. 12, 1888.

List of the skins, all mounted, and specimens preserved in alcohol of the family Tupaiidæ in the Leyden Museum, pp. 116–118. Contains the new generic term *Glipora* and the new specific names *leucogaster* and *rufescens*.

———. On a collection of Mammals from East Sumatra. Notes Leyden Museum, vol. 11, pp. 17–30, 1889.

Records *Tupaia javanica* (probably= *T. minor malaccana*), Tandjong Morawa, *T. tana* Deli, *T. ferruginea* Deli, *T. ferruginea* var. *chrysura* (= *T. demissa*), and *Ptilocercus lowii*, Tandjong Morawa.

———. On a collection of Mammals from Billiton. Notes Leyden Museum, vol. 12, pp. 149–154, 1890.

Records *Tupaja javanica* from Billiton; it is probably an example of *T. gracilis inflata*.

———. On two very rare, nearly forgotten and often misunderstood mammals from the Malayan Archipelago. Notes Leyden Museum, vol. 12, 1890, pp. 222–230.

Considers in detail the cotypes of *Tupaia dorsalis* Schlegel, and points out the similarity in form of the skulls of that species with those of *Tupaia tana*, both now in the genus *Tana*.

JERDON, T. C. Mammals of India, 1867, pp. 64–66.

Gives characters of the family and of *T. elliotti* and *T. chinensis*, remarks on food.

KLOSS, C. BODEN. In the Andamans and Nicobars, 1903.

An account of Abbott and Kloss's visit to those islands in 1901. Describes habits of *Tupaia nicobarica*, pp. 122, 136.

———. A Provisional List of the Mammals of the Peninsula Region. Journ. Fed. Malay States Mus., vol. 2, No. 3, pp. 147–150, September, 1908.

Tupaia ferruginea, *T. f. belangeri*, *T. sordida*, *T. pulonis*, *T. malaccana*, *Ptilocercus lowi*.

———. Diagnoses of new Mammals from the Trengganu Archipelago, east coast of Malay Peninsula. Ann. Mag. Nat. Hist., ser. 8, vol. 7, pp. 115–119, January, 1911.

Original descriptions of *Tupaia obscura* and *T. ferruginea longicauda*.

———. On Mammals and Birds from Trengganu. Journ. Fed. Malay States. Mus., vol. 4, No. 2, pp. 135–143, April, 1911.

Tupaia ferruginea recorded.

———. On Mammals and Birds from the lowlands of Pahang. Journ. Fed. Malay States Mus., vol. 4, No. 2, pp. 144–166, April, 1911.

Tupaia ferruginea and *T. malaccana* mentioned.

———. On a Collection of Mammals and other Vertebrates from the Trengganu Archipelago. Journ. Fed. Malay States Mus., vol. 4, pp. 175–212, November, 1911.

Detailed descriptions and measurements of *Tupaia obscura*, and *T. longicauda*; remarks on habits.

———. On Mammals and Birds from the Hills of Negri Sembilan. Journ. Fed. Malay States Mus., vol. 4, pp. 219–229, November, 1911.

Tupaia ferruginea recorded from Bukit Tangga.

KOHLBRUGGE, J. H. F. Bijdragen tot de natuurlijke Geschiedenis van Menschen en Dieren, III. Zoogdieren van Zuid-Oost Borneo. Nat. Tijdschr. Ned.-Ind., vol. 55, ser. 9, vol. 4, pp. 176–200, 1896.

Original description of *Tupaja Mülleri* (p. 196)= *T. splendidula*.

LECHE, W. Zur Anatomie der Beckenregion bei Insectivora, mit besonderer Berücksichtigung ihrer morphologischen Beziehungen zu derjenigen anderer Säugethiere. Kongl. Svenska Vet.-Akad. Handl., vol. 20, No. 4, 1883, pp. 1–113, pls. 1–10.

Descriptions and illustrations of the bony pelvis, the pelvic nerves, and muscles of Insectivora, among them a male *Tupaia ferruginea* and a female *T. javanica*.

———. Zur Morphologie des Zahnsystems der Insectivoren. Anat. Anzeiger, vol. 13, 1897, pp. 528–529.

Brief account of milk and permanent teeth of Tupaiidæ (*Tupaia tana*, *belangevi* (sic), and *melanura*).

LESSON, RÉNÉ-PRIMEVERRE. Manuel de Mammalogie, 1827, pp. 122–123.
Cladobates ferrugineus, tana, javanica.

———. Nouveau Tableau de Règne Animal, Mammifères, 1842, p. 93.
Tupaia ferruginea, T. javanica, T. tana T. peguanus, original description of latter.

LEWIS, CAPT. Observations of in E. Blyth. Journ. Asiat. Soc. Bengal, vol. 15, p. 368.
Mentions squirrels on the Nicobar Islands, probably = *Tupaia nicobarica.*

LICHTENSTEIN, H. Uber die Verwandtschaft der Kleinen (Insectenfressenden) Raubthiere mit den Nagern. Abhandl. kön Akad. Wissensch, Berlin (1831), 1832, pp. 345–360.
On p. 356 mere mention of resemblance between *Tupaya* and *Sciurus.*

LYDEKKER, RICHARD. The Tree-Shrews, or Tupaias. Royal Natural History, vol. 1, 1893–94, pp. 312–315.
A good popular account of the family with woodcuts of *Tana* and *Ptilocercus.*

———. A Geographical History of Mammals, 1896, pp. i–xii, 1–400.
On p. 270 gives distribution of family and a rather poor woodcut on p. 271, "*Tupaia tana,*" apparently taken from Günther's plate of *Tana chrysura.*

———. Insectivora (pp. 638–644), Encyl. Brit., ed. 11, vol. 14, 1910.
Brief account of the Tupaiidæ, genera *Tupaia, Ptilocercus,* and *Urogale. U. everetti* erroneously referred to Borneo.

LYON, MARCUS WARD Jr. Mammals of Banka Mendanau, and Billiton, islands between Borneo and Sumatra. Proc. U. S. Nat. Mus., vol. 31, pp. 575–612, December 18, 1906.
Original descriptions of *Tupaia inflata* and *T. discolor.*

———. Mammals of Batam Island, Rhio Archipelago. Proc. U. S. Nat. Mus., vol. 31, pp. 653–657, January 16, 1907.
Original description of *Tupaia ferruginea batamana.*

———. Mammals collected in western Borneo by Dr. W. L. Abbott. Proc. U. S. Nat. Mus., vol. 33, pp. 547–572, December 24, 1907.
Records *Tupaia dorsalis* and *T. spcciosa* from Lower Kapuas River (both nowi n genus *Tana* and the latter= *T. t. besara*).

———. On a collection of mammals from the Batu Islands, west of Sumatra. Ann. Mag. Nat. Hist., ser. 8, vol. 1, pp. 137–140, February, 1908.
Records *Tupaia cervicalis* from Tana Masa Island (now *Tana cervicalis masæ*).

———. Mammals collected in eastern Sumatra by Dr. W. L. Abbott during 1903, 1906, and 1907, with descriptions of new species and subspecies. Proc. U. S. Nat. Mus., vol. 34, pp. 619–679, September 17, 1908.
Original description of *Tupaia siaca; T. ferruginea* recorded from Aru Bay.

———. Additional Notes on Mammals of the Rhio-Linga Archipelago, with descriptions of new species and a revised list. Proc. U. S. Nat. Mus., vol. 36, pp. 479–491, June 1, 1909.
List of treeshrews occurring in the Archipelago.

———. Mammals collected by Dr. W. L. Abbott on Borneo and some of the small adjacent Islands. Proc. U. S. Nat. Mus., vol. 40, pp. 53–146, April 25, 1911.
Records *Tupaia speciosa* (now *Tana tana besara*) and *T. t. tana* from Kapuas River and southern Borneo; *T. dorsalis,* Kapuas River; *T. splendidula,* southern Borneo; *T. longipes* (now *T. l. salatana*), southern Borneo; *T. carimatæ,* Karimata Island; *T. inflata* (now *T. gracilis edarata*), Karimata Island; *T. grocilis* Kendawangan River; *T. minor,* southern Borneo and Pulo Laut.

———. Descriptions of four new treeshrews. Proc. Biol. Soc. Wash., vol. 24, pp. 167–170, June 16, 1911.
Original descriptions of *T. raviana, T. pemangilis, T. natunæ, T. sincipis,*

LYON, MARCUS WARD, Jr., and OSGOOD, WILFRED HUDSON. Catalogue of the Type-specimens of Mammals in the United States National Museum, including the Biological Survey Collection. Bull. U. S. Nat. Mus. 62, January 28, 1909.
The type-specimens of species in the family Tupaiidæ in the U. S. National Museum, listed, pp. 251–254.

MASON, Rev. FRANCIS. The natural productions of Burmah, 1850.
On p. 224 mentions *Tupaia javanica* and *peguana* (=*chinensis* and *belangeri*).

MATSCHIE, PAUL. Über Säugethiere von der Philippinen. Sitz-Ber. Ges. nat. Freunde, Berlin, 1898, pp. 38, 43.
Original description of *Tupaia möllendorffi*.

MEARNS, EDGAR A. Descriptions of new Genera and Species of Mammals from the Philippine Islands. Proc. U. S. Nat. Mus., vol. 28, pp. 425–460, May 13, 1905.
Original description of genus *Urogale* and species *cylindrura* (=*everetti*).

MEIJERE, J. C. H. DE. Über die Haare der Säugethiere, besonders über ihre Anordnung, pp. 312–424. Morph. Jahrb., vol. 21, 1894.
On p. 398, the arrangement of the hairs of *Tupaia javanica* and of *Ptilocercus lowii*, and schematic figure of the scales and hairs of tail of *Ptilocercus* (fig. 3, p. 319). Hairs arise, singly, and not in definite groups, 3 hairs to a scale in *Ptilocercus*. Hairs of *Tupaia* have a thickness of 0.016 to 0.020 mm., occasionally 0.065 mm. Hairs of *Ptilocercus* 0.012 mm. in diameter.

MILLER, GERRIT S., Jr. Mammals collected by Dr. W. L. Abbott on Islands in the South China Sea. Proc. Wash. Acad. Sci., vol. 2, pp. 203–246, August 20, 1900.
Original descriptions of *Tupaia bunoæ*, *T. sordida*, *T. chrysomalla*. *T. tana* (now *Tana lingæ*) recorded from Linga Island, *T. malaccana*, from Linga, with illustrations of skull of latter.

———. Mammals collected by Dr. W. L. Abbott on Pulo Lankawi and the Butang Islands. Proc. Biol. Soc. Wash., vol. 13, pp. 187–193, December 21, 1900.
Records *Tupaia ferruginea* on Pulo Lankawi and Butang Islands, and also at Trong, Lower Siam. At present these represent 3 forms of *Tupaia lacernata*. At the time of Miller's paper examples of true *Tupaia glis ferruginea* were not in the United States National Museum collection.

———. Mammals collected by Dr. W. L. Abbott on the Natuna Islands. Proc. Wash. Acad. Sci., vol. 3, pp. 111–138, March 26, 1901.
Original description of *Tupaia* (now *Tana*) *sirhassenensis*. *T. splendidula* (now *natunæ*) recorded on Bunguran, and *T. lucida* on Laut.

———. The Mammals of the Andaman and Nicobar Islands. Proc. U. S. Nat. Mus., vol. 24, pp. 751–795, May 28, 1902.
Original description of *Tupaia nicobarica surda*, Little Nicobar, and record of *T. n. nicobarica* on Great Nicobar.

———. Mammals collected by Dr. W. L. Abbott in the region of the Indragiri River, Sumatra. Proc. Acad. Nat. Sci. Phila., 1902, pp. 143–159, June 11, 1902.
Original description of *Tupaia phæura*, Sinkep Island. *T. malaccana* recorded from Linga Island and Indragiri River, and from Sinkep (now *T. minor sincipis*), and *T. tana* from Linga (now *Tana lingæ*).

———. Mammals collected by Dr. W. L. Abbott on the coast and islands of northwest Sumatra. Proc. U. S. Nat. Mus., vol. 26, pp. 437–484, February 3, 1903.
Records *Tupaia ferruginea*, Loh Sidoh and Tapanuli Bays; *T. tana* (now *Tana tana tuancus*) from Tuangku Island, *T. malaccana* from Tapanuli Bay.

———. Seventy New Malayan Mammals. Smiths. Misc. Coll., vol. 45, No. 1420, pp. 1–73, pls. 1–19, text fig. 1, November 6, 1903.
Original descriptions of *Tupaia castanea*, Bintang Island; *T. pulonis*, Pulo Aor; *T. tephrura*, Tana Bala Island; *T. chrysogaster*, Pagi Islands (skull, fig. 1, pl. 10); *T. cervicalis*, Tana Bala Island. Views of skull of *Tupaia ferruginea* from Tringanu, fig. 2, pl. 10. Key to species of *splendicula* group=*T. lucida*, *T. splendidula*, *T. chrysomalla*, and *T. castanea*.

———. Mammals collected by Dr. W. L. Abbott in the Karimata Islands, Dutch East Indies. Proc. U. S. Nat. Mus., vol. 31, pp. 55–66, July 23, 1906.
Original description of *Tupaia carimatæ*.

MILLER, GERRIT S., Jr. The Mammals collected by Dr. W. L. Abbott in the Rhio-Linga Archipelago. Proc. U. S. Nat. Mus., vol. 31, pp. 247–286, September 11, 1906.

Records *Tupaia castanea* from Pulo Bintang; *T. tana* (now *Tana lingæ*) from Linga; *T. phæura* from Sinkep; *T. ferruginea* (now *T. glis batamana*) from Batam; *T. malaccana* from Linga and Sinkep (now part *T. minor sincipis*).

———. Descriptions of two new genera and sixteen new species of mammals from the Philippine Islands. Proc. U. S. Nat. Mus., vol. 38, pp. 391–404, August 19, 1910.

Original description of *Tupaia cuyonis*, p. 393.

MIVART, ST. GEORGE. Notes on the Osteology of the Insectivora, Journ. Anat. Physiol., vol. 1, 1867, pp. 292–295, and vol. 2, 1868, pp. 145–146.

Describes skull, osteology, and teeth of *Tupaia*, and illustrates trunk vertebræ, and grinding surface of upper molars of *Tupaia* and *Ptilocercus* and lower of *Tupaia*.

———. Notes sur l'ostéologie des insectivores. Ann. Sci. Nat., Paris, ser. 5, vol. 8, 1867, pp. 221–284, and vol. 9, 1868, pp. 311–372.

A publication in French of the above.

———. On Hemicentetes, a new genus of Insectivora, with some additional remarks on the osteology of that order. Proc. Zool. Soc. London, 1871, pp. 67–79.

A general account of the families and genera of Insectivora. Osteological characters of Tupaiidæ well set forth. Three genera recognized in family, *Tupaia, Ptilocercus, Hylomys*.

MODIGLIANI, E. Appunti intorno ai mammiferi dell' isola Nias. Ann. Mus. Civ. Stor. Nat. Genoa, ser. 2, vol. 7 (27), 1889, pp. 238–245.

Records *Tupaia javanica* on Nias.

MURRAY, A. Geographical Distribution of Mammals, 1866, p. 233, map 65.

Briefly gives distribution, not mentioning Ceylon, but the colored area of distribution on the map includes Ceylon.

NEHRING, ALFRED. Über Säugethiere von den Philippinen, namentlich von der Palawan-Gruppe. Sitz.-Ber. Ges. naturf. Freunde, Berlin, 1894, pp. 179–193.

On p. 184 records *Tupaia ferruginea* from the Calamines (= *T. palawanensis*) and probably came from Palawan.

OSBORN, HENRY FAIRFIELD. The Age of Mammals in Europe, Asia, and North America, 1910.

On p. 522, under classification of Mammals: Suborder Menotyphla, Family Tupaiidæ, genera *Tupaia*, *Ptilocercus*, and family Macroscelididæ.

OWEN, RICHARD. Odontography, vol. 1, p. 419, vol. 2, pl. 111, fig. 3, 1840–1845.

Illustrations and descriptions of teeth of *Tana*.

PALMER, T. S. Index Genera Mammalium=North American Fauna, No. 23, 1904.

On page 875 are gathered together the family, subfamily names, genera, and subgenera, the latter fully discussed in the body of the work. The only omission I have noticed is *Glipora* Jentink.

PARKER, W. K. Development of the skull in the Mammalia; a few remarks on an adult skull of *Tupaia javanica*. Philos. Trans. Royal Soc. London, vol. 176, year 1885, pp. 267–8, pl. 1, 1886.

A rather brief account, showing *Tupaia* rather primitive, with certain marsupial affinities, but in brain capacity approaching lemurs.

PAULLI, SIMON. Über die Pneumaticität des Schädels bei den Säugethieren, Morph. Jahrb., vol. 28, pp. 483–564.

On p. 486, endo and ecto turbinals of *Cladobates* discussed, peculiar among the Insectivora in having only 2 ecto-turbinals instead of 3.

PECHUEL-LOESCHE. Brehms Tierleben, 1890, vol. 2, pp. 382–383.

Brief account of Tupaiidæ, but *Ptilocercus* omitted.

Woodcut of *Tana*.

PELZELN, AUGUST VON. Über die malayische Säugethier-Fauna, K. k. zool. bot. Ges. Wien, 1876, pp. 53–74, and map.

Tupaia mentioned as occurring in his "tibetanische hinterindien and sundaishe Unterabteilung."

PETERS, WILHELM. Über die Säugethier-Gattung Solenodon. Abh. kön Akad. Wiss., Berlin, 1863, p. 20.
Outline classification of Insectivora, under Tupayæ: 1. Cladobates; 2. Ptilocercus; 3. Hylogale.

POMEL, A. Études sur les carnassiers insectivores (extrait), Seconde-Partie.—Classification des insectivores. Arch. Sci. Phys. Nat. Genève, vol. 9, 1848, pp. 244–251.
On p. 250 the treeshrews, called Hylogaliens (one genus *Sorexglis*), the first type of the tribe Glisoriciens (Glisoricina), the second type being Dipogaliens with the genera *Macroscelis* and *Petrodromus*.

POUSARGUES, E. DE. Mammifères de l'Indo-Chine. Mission Pavie Indo-Chine, 1879–1895, Études diverses, III, Recherches sur l'Histoire Naturelle de l'Indo-Chine orientale, pp. 510–549.
Mentions as occurring in Indo-China *Tupaia chinensis*, *T. belangeri*, *T. ferruginea*, *Dendrogale frenata* (p. 520).

RAFFLES, Sir THOMAS STAMFORD. Descriptive Catalogue of a zoological collection made on the account of the Honourable East India Company, in the Island of Sumatra and its vicinity, etc. Trans. Linn. Soc. London, vol. 13 (1822), pp. 239–274 (mammals), May, 1821.
Original description of the genus *Tupaia* and species *ferruginea* and *tana;* remarks on habits.

RIDLEY, H. N. On the Dispersal of Seeds by Mammals. Journ. Straits Branch Royal Asiat. Soc., No. 25, pp. 11–32, 1894.
On p. 21 mentions eating of fruits by *Tupaia ferruginea*.

———. List of Mammals recorded from Pahang. Journ. Straits Branch Royal Asiat. Soc., No. 25, pp. 57–60, 1894.
Tupaia ferruginea and *T. javanica* (probably = *T. minor malaccana*.)

———. The Mammals of the Malay Peninsula. Natural Science, vol. 6, January, 1895, pp. 23–29.
Excellent remarks on the habits of *Tupaia glis ferruginea*.

ROBINSON, H. C. A List of a Small Collection of Mammals and Birds from the Mountains of Ulu Langat, Selangor. Journ. Fed. Malay States Mus., vol. 4, November, 1911, pp. 235–241.
Records *Tupaia ferruginea ferruginea*.

H. C. R[OBINSON] and C. B[ODEN] K[LOSS]. In Thomas and Wroughton, Journ. Fed. Malay States Mus., vol. 4, No. 1, December, 1909, pp. 111–112.
Notes on the habits of *Tupaia ferruginea*.

———. On Six New Mammals from the Malay Peninsula and Adjacent Islands. Journ. Fed. Malay States Mus., vol. 4, No. 2, pp. 169–174, April, 1911.
Original description of *Tupaia ferruginea wilkinsoni*.

———. On New Mammals from the Malay Peninsula and Adjacent Islands. Journ. Fed. Malay States Mus., vol. 4, pp. 241–246, November, 1911.
Original description of *Tupaia ferruginea penangensis* = *Tupaia glis glis*, Penang Island.

SCHINZ, H. R. Naturgeschichte und Abbildungen der Menschen und der Säugethiere, p. 54
Brief description of "*Gladobates* (sic) *ferrugineus*." "It lives in Java." Black and white figure on plate 11. Evidently compiled from Cuvier.

———. Naturgeschichte und Abbildungen der Säugethiere, 1824, pp. 87–88, pl. 62.
Brief description and black and white illustration of "*Chladobates* (sic) *javanicus*." Evidently compiled from Cuvier. Among the known species in the genus are "Der gestreifte Tupaja. *Cladob. vittatus*, in Sumatra. Der Tana, *Cladob. tana*, in Sumatra. Der rostfarbe Tupaja. *Cladob. ferrugineus*, in Java."

SCHLEGEL, HERMANN. Handleiding to de Beoefening der Dierkunde, 1857, vol. 1, pp. 58–59, pl. 3, fig. 31 (⅔).
Describes the genus *Tupaia* and mentions in it *javanica*, *tana*, *dorsalis* (new), black and white figure of latter.

SCHLEGEL, HERMANN. Die Dierentuin van het Kon. Zool. Gen. Natura Artis Magistra, Mammalium, 1872.

Rather poor woodcut of *Tana dorsalis* on page 62; short description of genus; species mentioned, *javanica, tana, dorsalis.*

SCHLEGEL, HERMANN, and MÜLLER, SAL. Over de op de oostindische eilanden levende soorten van het geslacht *Hylogalea.* Verh. Nat. Gesch. Nederl overz. Bezitt., 1843, pp. 159–168, pls. 26 and 27.

Descriptions of the 4 then known Malayan species, *tana, ferruginea, javanica, murina* (new); colored illustrations of the heads of the others, and entire animal of *murina;* drawing of skulls and bones of feet of all; original publication of *Hylogalea* as the generic term for the treeshrews.

SCHNEIDER, GUSTAV. Ergebnisse zoologischer Forschungsreisen in Sumatra O. K. Zool. Anzeiger, vol. 27, pp. 722–724, July 12, 1904.

Contains original description of *Tupaia ferruginea demissa.* See Oldfield Thomas.

——— Ergebnisse zoologischer Forschungsreisen in Sumatra. Säugetiere (Mammalia). Zool. Jahrb., vol. 23, 1905, pp. 1–172.

Records specimens collected in the Deli and Indragiri regions, enumerating *Ptilocercus lowii, Tupaia ferruginea, T. f. demissa, T. splendidula* (probably *T. siaca*), *T. castanea* (= *T. siaca*), *T. javanica, T. malaccana, T. tana,* and *T. tana* var. *specciosa* (the latter two probably represent the same form, *tana*). Interesting remarks on living specimens of *Ptilocercus.* Illustrations in colors, plates 1 and 2 of *Ptilocercus* and *Tupaia demissa.*

SCLATER, W. L. and P. L. Geography of Mammals, 1899, p. 145.

Mentions *Tupaia* and *Ptilocercus* as being very characteristic of the Malayan Subregion of the Oriental Region.

SCUDDER, SAMUEL H. Nomenclator Zoologicus. Bull. U. S. Nat. Mus., No. 19, 1882.

In part 2, p. 130, original publication of *Glirisorex.*

STERNDALE, R. A. Natural History of the Mammalia of India and Ceylon, 1884, pp. 99–104.

Describes the mainland and Nicobar species and includes *Ptilocercus,* thinking it may be found in Tenasserim. Remarks on habits, etc., mostly quoted.

STONE, WITMER, and REHN, J. A. G. A collection of Mammals from Sumatra, with a Review of the genera Nycticebus and Tragulus. Proc. Acad. Nat. Sci. Phila., 1902, pp. 127–142.

Tupaia tana recorded from Gunong Sugi, Lampong District, Sumatra.

TEMMINCK, C. J. Monographies de Mammalogie, vol. 1, 1827.

On p. 19 first use of *Hylogale* for the "barbarous" *Tupaia.*

THOMAS, OLDFIELD. On the Mammals presented by Allan O. Hume, Esq., C. B., to the Natural History Museum. Proc. Zool. Soc. London, 1886, pp. 54–79.

Records *Tupaia belangeri* (now called *chinensis*) from Aimole and Machi Manipur; *T. belangeri* and *T. ferruginea* from Tenasserim; *T. ferruginea* from Malacca and Selangor; *T. javanica* (probably *T. malaccana*) from Selangor and Johore.

———. On the Mammals of Mount Kina Balu, North Borneo. Proc. Zool. Soc. London, 1889, pp. 228–236.

On p. 229 records 3 specimens of *Tupaia ferruginea* from Mount Kina Balu, collected by John Whitehead. They were probably examples of *T. montana baluensis.*

———. On a Collection of Mammals obtained by Dr. Emin Pasha in Central and Eastern Africa. Proc. Zool. Soc. London, 1890, pp. 443–450.

Remarks on the teeth of the Macroscelididæ and figure of the milk dentition of *Petrodromus.*

———. On some new Mammalia from the East Indian Archipelago. Ann. Mag. Nat. Hist., March, 1892.

Original description of *Tupaia everetti* (now *Urogale everetti*) and *T. picta, T. montana, T. malanura* (now *Dendrogale melanura*).

———. On some Mammals from Mount Dulit, North Borneo. Proc. Zool. Soc. London, 1892, pp. 221–227.

Among them *Tupaia tana, montana, minor, melanura,* and on p. 227, *T. dorsalis.*

THOMAS, OLDFIELD. On the Mammalia collected by Signor Leonardo Fea in Burma and Tenasserim. Ann. Mus. Civ. Stor. Nat. Genoa, ser. 2, vol. 10 (1890–91), pp. 913–949, 1892.

On p. 920 records *Tupaia ferruginea belangeri* (embracing both *belangeri* and *chinensis* of the present paper). Discusses number of mammæ in *T. ferruginea, tana, ellioti,* and *javanica.*

———. On some new Bornean Mammalia. Ann. Mag. Nat. Hist., ser. 6, vol. 11, pp. 341–347, May, 1893.

Original description of *Tupaia ferruginea longipes.*

———. Description of a new Bornean Tupaia. Ann. Mag. Nat. Hist., ser. 6, vol. 12, pp. 53, 54, July, 1893.

Original description of *Tupaia gracilis.*

———. On the Palawan Representative of *Tupaia ferruginea.* Ann. Mag. Nat. Hist., ser. 6, vol. 13, p. 367, April, 1894.

Original description of *Tupaia ferruginea palawanensis.*

———. On some Mammals collected by Dr. E. Modigliani in Sipora, Mentawei Islands. Ann. Mus. Civ. Stor. Nat. Genoa, ser. 2, vol. 14, pp. 661–672, January, 1895.

Original description of *Tupaia ferruginea hypochrysa,* type-locality, Java.

———. In Schneider, Gustav. Ergebnisse zoologischer Forschungsreisen in Sumatra, O. K. Zool. Anzeiger, vol. 27, pp. 722–724, July 12, 1904.

Original description of *Tupaia ferruginea demissa.*

———. The Duke of Bedford's Zoological Exploration in Eastern Asia.—III. On Mammals obtained by Mr. M. P. Anderson in the Philippine Islands. Proc. Zool. Soc. London, 1907, pp. 140–142, June 12, 1907.

Remarks on status of *Urogale everetti* and *U. cylindrura,* p. 140.

———. On Mammals collected by Mr. H. C. Robinson on Tioman and Aor Islands, S. China Sea. Journ. Fed. Malay States Mus., vol. 2, No. 3, pp. 101–106, 1908.

Records *Tupaia sordida* on Tioman.

———. Two new Mammals from the Malay Peninsula. Ann. Mag. Nat. Hist., ser. 8, vol. 5, pp. 424–426, May, 1910.

Original description of *Ptilocercus lowi continentis.*

THOMAS, OLDFIELD, and HARTERT, ERNST. List of the first collection of Mammals from the Natuna Islands. Nov. Zool., vol. 1, pp. 652–660, September, 1894.

Record *Ptilocercus lowi* on Sirhassen and *Tupaia splendidula* (now *natunæ*) on Bunguran and *T. tana* (now *sirhassenensis*) on Sirhassen.

———. On a second collection of Mammals from the Natuna Islands. Nov. Zool., vol. 2, December, 1895, pp. 489–492.

Tupaia splendidula typica recorded from Bunguran (now *T. natunæ*) and original description of *Tupaia splendidula lucida.*

THOMAS, OLDFIELD, and WROUGHTON, R. C. Diagnoses of new Mammals collected by Mr. H. C. Robinson in the islands of the Straits of Malacca. Ann. Mag. Nat. Hist., ser. 8, vol. 4, pp. 534–536, December, 1906.

Original description of *Tupaia lacernata.*

———. On Mammals from the Rhio Archipelago and Malay Peninsula collected by Messrs. H. C. Robinson, C. Boden Kloss, and E. Seimund, and presented to the National Museum by the Government of the Federated Malay States. Journ. Fed. Malay States Mus., vol. 4, No. 1, pp. 99–129, December, 1909.

Tupaia castanea on Bintang *T. ferruginea,* S. E. Johore and Singapore; *T. f. batamana* on Batam. Notes by Robinson and Kloss on *T. ferruginea.*

TROUESSART, E.-L. Catalogus Mammalium tam viventium quam fossilium, vol. 1, 1897, pp. 167–169.

Ptilocercus, 1 form; *Tupaia*, subgenus *Dendrogale*, 2 forms; subgenus *Tupaia*, 20 forms.

Vol. 2, 1899, appendix, pp. 1286, 1287. Two additional species of *Tupaia*.

Quinquennale Supplementum Anno 1904, pp. 120–123. The species and subspecies of subgenus *Tupaia* now 28.

[VIGORS.] Catalogue of Zoological Specimens. Memoir of the Life and Public Services of Sir Thomas Stamford Raffles, etc., by Sophia Raffles, London, 1830.

Pages 637–638, genus *Tupaia*. *Tup. Tana*, Sumatra. *Tup. Javanica*, Java. *Tup. ferruginea*, Sumatra.

VOGT, CARL, and SPECHT, FRIEDERICH. Die Säugetiere in Wort und Bild, 1883.

On p. 87 a short account of treeshrews and wood cut. *Cladobates*, *Ptilocercus*, (*Hylomys* also included), family Tupajæ.

WAGLER, J. G. Naturliches System der Amphibien mit vorangehender Classification der Säugthiere und Vögel, 1830.

On p. 15, genus 9, *Hylogale*, with the species *ferruginea*, *tana*, *javanica*.

WAGNER, J. A. Schreber's Säugthiere, Supplementband, 2. Abtheilung, 1841, pp. 37–44, p. 553.

Systematic account of the known Tupaiidæ, *Cladobates tana*, p. 40; *C. ferrugineus*, p. 41; *C. belangeri* (new), p. 42; *C. speciosus* (new), p. 43; *C. javanicus*, p. 44; *C. murinus*, p. 553.

———. Schreber's Säugthiere, Supplementband, 5. Abth. 1856, pp. 524–529, and pls. 34 and 35, in colors.

Descriptions of *Cladobates tana*, p. 525; *Cl. ferrugineus*, p. 526, pl. 34; *Cl. ellioti*, p. 526; *Cl. javanicus*, p. 527; *Cl. belangeri*, p. 527; *Cl. murinus* (subgenus *Dendrogale*), p. 528; *Ptilocercus lowii*, pl. 35.

WALLACE, A. R. Geographical Distribution of Animals, 1876, vol. 1, p. 337, pl. 8, vol. 2, p. 187.

Mentions in a very general way the distribution of the family. *Hylomys* is regarded as a member of the Tupaiidæ.

———. Island Life, 1881.

On p. 345, list of the then known Bornean Tupaiidæ, *Tupaia*, *Dendrogale*, *Ptilocerus* (sic).

WATERHOUSE, G. R. Catalogue of the Mammalia preserved in the Museum of the Zoological Society of London, 1838.

On page 19 four specimens listed, *Tupaia tana* (probably the original specimen), *T. javanica*, *T. ferruginea*.

———. Description of a new species of *Tupaia* discovered in Continent of India by Walter Elliot, Esq. Proc. Zool. Soc. London, 1849, pp. 106–108, pl. 13.

Original description of *Tupaia ellioti* in comparison with *T. tana*, *ferruginea*, and *javanica*; very good plate in colors.

WEBER, MAX. Die Säugethiere, 1904.

Pages 376 and 377, family Tupaiidæ defined; two genera recognized, *Tupaia*, *Ptilocercus*.

WILLINK, T. Mammalia voorkomende in Nederlandsch-Indië. Nat. Tijdschr. Ned.-Ind., vol. 65, pp. 296–300, 1905.

A list of Tupaiidæ known up to 1905 and occurring in the Dutch East Indies, compiled and non-critical.

WINGE, HERLUF. Jordfundne og nulevende Flagermus (Chiroptera) fra Lagoa Santa, Minas Geraes, Brasilien.

Pages 41–51, various osteological and anatomical observations on treeshrews, usually designated as *Cladobates*, sometimes as *Tupaia*.

ZELEBOR, JOHANN. Säugethiere. Reise der österreichischen Fregatte *Novara* um die Erde in den Jahren 1857, 1858, 1859. Zool. Theil, vol. 1, 1869, pp. 1–42, pls. 1–3.

Original description of *Tupaia nicobarica*, with a plate in colors of entire animal and a plate illustrating skeleton, skull, and teeth.

EXPLANATION OF PLATES.

Plate 1.

Tupaia dissimilis, Pulo Condore. Reproduction of the original figure of William Ellis' *Sciurus dissimilis*, in his natural history journal, written during Capt. Cook's third voyage, 1776–1780; now in the British Museum (Natural History). Reproduced by the permission of the authorities of the British Museum. A scale of 100 mm. was laid on the page when photograph was made.

Plate 2.

Skeleton of *Tupaia lacernata wilkinsoni;* Cat. No. 49468, U.S.N.M., Tarang, Lower Siam; collected by Dr. W. L. Abbott. About one-half natural size.

Plate 3.

External appearance of *Tupaia nicobarica*, *T. javanica*, *T. minor*, and *T. glis*. About one-third natural size.

Fig. 1. *Tupaia nicobarica surda;* Type; Cat. No. 111757, U.S.N.M., Little Nicobar Island; Dr. W. L. Abbott, collector.

2. *Tupaia javanica;* Cat. No. 154598, U.S.N.M., Mount Salak, Java; Bryant and Palmer, collectors.
3. *Tupaia minor minor;* Cat. No. 145575, U.S.N.M., Sempang River, western Borneo; Dr. W. L. Abbott, collector.
4. *Tupaia glis ferruginea;* Cat. No. 114548, U.S.N.M., Tapanuli Bay, west coast of Sumatra; Dr. W. L. Abbott, collector.

Plate 4.

External appearance of *Anathana ellioti* (Waterhouse). After the original plate in colors by Waterhouse in the Proceedings of the Zoological Society of London for 1849.

Plate 5.

External appearance of *Dendrogale murina* (Schlegel and Müller). After the original figure in Verhandelingen over de Natuurlijke Geschiedenis der Nederlandsche Overzeesche Bezittingen, 1843.

Plate 6.

External appearance of *Tana cervicalis*, *T. dorsalis*, *Urogale everetti*. About one-third natural size.

Fig. 1. *Tana cervicalis cervicalis;* Type; Cat. No. 121754, U.S.N.M., Tana Bala, Batu Islands, off west coast of Sumatra; Dr. W. L. Abbott, collector.

2. *Tana dorsalis;* Cat. No. 142245, U.S.N.M., Kapuas River, western Borneo; Dr. W. L. Abbott, collector.
3. *Urogale everetti;* Cat. No. 125287, U.S.N.M. (Type of *U. cylindrura*), Mount Apo, Mindanao, Philippine Islands; Dr. E. A. Mearns, collector.

Plate 7.

External appearance of *Ptilocercus lowii* Gray. After the original plate by Gray in the Proceedings of the Zoological Society of London for 1848.

PLATE 8.

Skulls of Treeshrews of the genus *Tupaia*. All figures natural size.

Fig. 1. *Tupaia chinensis;* Cat. No. 37384, U.S.N.M., Carin Hills, Burma; Leonardo Fea, collector.
2. *Tupaia belangeri;* Cat. No. 124284, U.S.N.M., Telok Besar, Tenasserim; Dr. W. L. Abbott, collector.
3. *Tupaia lacernata wilkinsoni;* Cat. No. 83254, U.S.N.M., Trong, or Tarang, Malay Peninsula; Dr. W. L. Abbott, collector.
4. *Tupaia lacernata raviana;* Type; Cat. No. 104355, U.S.N.M., Pulo Rawi, Butang Islands, west coast Malay Peninsula; Dr. W. L. Abbott, collector.
5. *Tupaia lacernata lacernata;* Cat. No. 123901, U.S.N.M., Pulo Lankawi, west coast Malay Peninsula; Dr. W. L. Abbott, collector.
6. *Tupaia glis ferruginea;* Cat. No. 141074, U.S.N.M., Tarussan Bay, west coast of Sumatra; Dr. W. L. Abbott, collector.
7. *Tupaia tephrura;* Type; Cat. No. 121752, U.S.N.M., Tana Bala, Batu Islands, southwest coast of Sumatra; Dr. W. L. Abbott, collector.
8. *Tupaia glis glis;* Cat. No. 1444/11, Selangor Museum, Penang Island, west coast Malay Peninsula.
9. *Tupaia glis batamana*; Type; Cat. No. 142151, U.S.N.M., Batam Island, Rhio Archipelago; Mr. C. Boden Kloss, collector.

PLATE 9.

Skulls of treeshrews of the genus *Tupaia*. All figures natural size.

Fig. 1. *Tupaia cuyonis;* Type; Cat. No. 26, Philippine Museum, Cuyo, Philippine Islands; McGregor and Celestino, collectors.
2. *Tupaia montana montana;* Cat. No. 84507, U.S.N.M., Mount Dulit, northern Borneo; Charles Hose, collector.
3. *Tupaia picta*; Cat. No. 84506, U.S.N.M., Baram District, northern Borneo; Charles Hose, collector.
4. *Tupaia discolor;* Type; Cat. No. 124703, U.S.N.M., Island of Banka; Dr. W. L. Abbott, collector.
5. *Tupaia longipes salatana;* Type; Cat. No. 151882, U.S.N.M., Pangkallahan River, Klumpang Bay, southeastern Borneo; Dr. W. L. Abbott, collector.
6. *Tupaia hypochrysa;* Cat. No. 154599, U.S.N.M., Mount Salak, western Java; Bryant and Palmer, collectors.
7. *Tupaia phæura;* Type; Cat. No. 113148, U.S.N.M., Sinkep Island; Dr. W. L. Abbott, collector.
8. *Tupaia glis sordida;* Type; Cat. No. 101747, U.S.N.M., Pulo Tioman, off southeast coast Malay Peninsula; Dr. W. L. Abbott, collector.
9. *Tupaia chrysogaster;* Type; Cat. No. 121572, U.S.N.M., North Pagi Island, southeast coast of Sumatra; Dr. W. L. Abbott, collector.

PLATE 10.

Skulls of treeshrews of the genera *Tupaia* and *Ptilocercus*. All figures natural size.

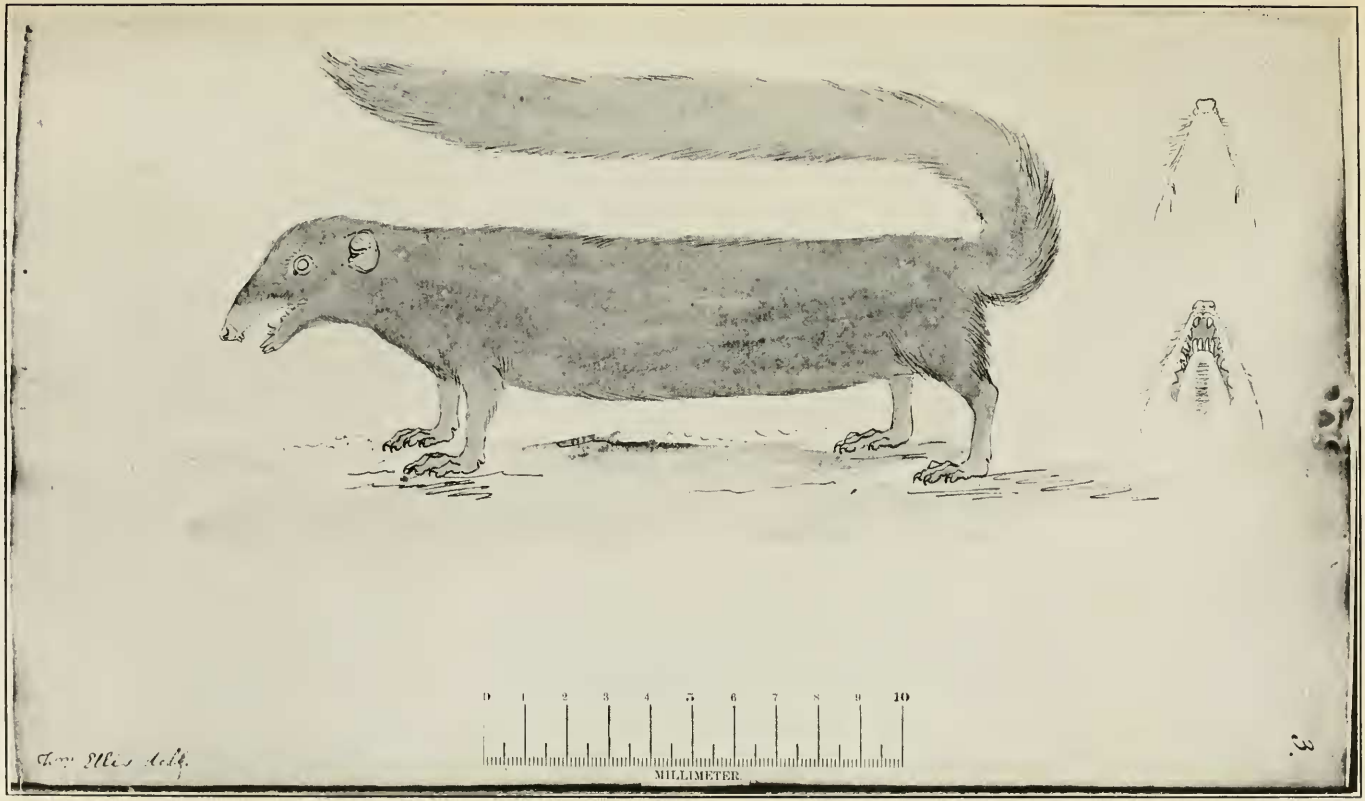
Fig. 1. *Tupaia javanica;* Cat. No. 121488, U.S.N.M., near Batavia, Java.
2. *Tupaia gracilis inflata;* Type; Cat. No. 124709, U.S.N.M., Island of Banka; Dr. W. L. Abbott, collector.
3. *Tupaia minor minor;* Cat. No. 153857, U.S.N.M., Kendawangan River, southwestern Borneo; Dr. W. L. Abbott, collector.
4. *Tupaia minor malaccana*; Cat. No. 112618, Sembrong River, Johore; Dr W. L. Abbott, collector.
5. *Ptilocercus lowii continentis;* Cat. No. 112611, U.S.N.M., Sembrong River, Johore; Dr. W. L. Abbott, collector.

Fig. 6. *Tupaia carimatæ;* Type; Cat. No. 125123, U.S.N.M., Karimata Island. Dr. W. L. Abbott, collector.
7. *Tupaia nicobarica surda;* Type; Cat. No. 111757, Little Nicobar, Nicobar Islands; Dr. W. L. Abbott, collector.
8. *Tupaia siaca;* Type; Cat. No. 144205, U.S.N.M., Little Siak River, eastern Sumatra; Dr. W. L. Abbott, collector.
9. *Tupaia castanea;* Type; Cat. No. 115608, U.S.N.M., Pulo Bintang, Rhio Archipelago; Dr. W. L. Abbott, collector.
10. *Tupaia chrysomalla;* Type; Cat. No. 101710, U.S.N.M., Pulo Siantan, Anamba Island, South China Sea; Dr. W. L. Abbott, collector.
11. *Tupaia splendidula;* Cat. No. 153856, U.S.N.M., Kendawangan River, southwestern Borneo; Dr. W. L. Abbott, collector.
12. *Tupaia natunæ;* Type; Cat. No. 104714, U.S.N.M., Bunguran, Natuna Islands; Dr. W. L. Abbott, collector.

PLATE 11.

Skulls of treeshrews of the genera *Tana* and *Urogale*. All figures natural size.

Fig. 1. *Tana dorsalis;* Cat. No. 142245, U.S.N.M., Kapuas River, western Borneo; Dr. W. L. Abbott, collector.
2. *Tana lingæ;* Type; Cat. No. 101597, U.S.N.M., Linga Island; Dr. W. L. Abbott, collector.
3. *Tana tana sirhassenensis;* Type; Cat. No. 101712, U.S.N.M., Sirhassen, Natuna Islands; Dr. W. L. Abbott, collector.
4. *Tana tana tana;* Cat. No. 174612, Landak region, Sumatra; Gustav Schneider, collector.
5. *Tana tana bunoæ;* Type; Cat. No. 101640, Bunoa, Tambelan Islands, South China Sea; Dr. W. L. Abbott, collector.
6. *Urogale everetti;* Cat. No. 125287, U.S.N.M. (type of *U. cylindrura*), Mount Apo, Mindanao, Philippine Islands; Dr. E. A. Mearns, collector.
7. *Tana cervicalis cervicalis;* Type; Cat. No. 121754, U.S.N.M., Tana Bala, Batu Islands, southwest coast of Sumatra; Dr. W. L. Abbott, collector.
8. *Tana tana besara;* Type; Cat. No. 142247, U.S.N.M., Kapuas River, western Borneo; Dr. W. L. Abbott, collector.



CONDORE ISLAND TREESHREW, TUPAIA DISSIMILIS FROM ELLIS' MANUSCRIPT JOURNAL, 1780.

FOR EXPLANATION OF PLATE SEE PAGE 181.